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The Journal of HEREDITY

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THE BREADFRUIT
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JONES—PLANT BREEDER
EDUCATIONAL ANTHROPOLOGY
THE INHERITANCE OF ZYGODACTYLY
PROCEEDINGS OF THE EUGENICS CONGRESS
AN AUSTRALIAN CITRUS RELATIVE
THE INHERITANCE OF ABILITY
FIGS WITH MISPLACED SCALES
RED-GREEN COLOR-BLINDNESS
TWINS REARED APART
HOME AND SCHOOL

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THE BREEDER AND HIS PRODUCT

Mr. N. A. Jones and one of his hybrid wheats. Men like Jones in New York and Etter in California are necessary for agricultural progress and prosperity, the basis of our civilization. Is it not just and expedient that a system of plant patents be perfected to protect breeders, and insure their reaping a sufficient reward from their lifelong labours to prevent pecuniary difficulties and other worries interferring with their work? See N. A. Jones—Plant Breeder, P. 103 (Frontispiece).

IS THE CHINESE HEREDITY INFERIOR?

CHO WANG
Cornell University, Ithaca, New York

ACCORDING to the view of most biologists the ultimate value and accomplishments of any people are determined by its heredity. The negro race has been accused of its relatively low mental ability and consequently its poor contribution to civilization. The white race is very proud of its heredity; geographical and other forces have been operating in favor of the showing up of its potential ability. The yellow race, especially the Chinese, has long been regarded as a mystery to the western people, and the value of its heredity is rarely understood.

It is very interesting to note that many foreigners, especially Americans who have been observing and studying the Chinese for many years, have come to the conclusion that the Chinese are hereditarily very strong. Unfortunately this worthy idea is often overlooked or unknown to many—particularly to the Chinese. In order to accomplish any task the performer must have confidence in his ability, and a friendly, sympathetic understanding of others. A consideration of the Chinese heredity, therefore, is not only enlightening to the foreigner, but imperative to all Chinese.

One of the most accurate criteria with which to measure the heredity of a people is its historical accomplishment. Chinese history and civilization are the longest of the unbroken, living ones of the world, and who has the slightest doubt that they are due to heredity? The Emperor Hwang-ti invented the compass and his Queen the silk-worm culture long before Greece or Rome came into existence. One after another of such epoch-making inventions as gun powder, printing, and others were contributed to the world by the slant-eyed Chinese. These facts demonstrate clearly that the Chinese are not lacking in originality; if they had never accomplished anything else, they would be justified in being proud of themselves.

The writer is fully aware of the repeated accusations that the Chinese are a backward people. It is granted that the Chinese developed a high civilization in ancient times, but it is said that their heads are bent to the past, and that, consequently, progress decreased and finally changed to stagnation; and the glorious days of China are in the past. The writer does not deny that there was a slowing down movement starting about the Christian era, but he does deny that the condition may be termed "backwardness." The retardation of Chinese civilization was not caused by Chinese religion, philosophy, habit of thinking or any other already attributed agencies, but mainly by geographical isolation. During the Han Dynasty (85 B.C. to 327 A.D.) the Chinese had conquered all that was to be conquered, secured all their material desires within the boundaries of their Empire, and, above all, attained higher culture and civilization than all their neighboring states. Is it not human nature to "slow down," if a people are satisfied with what they have, with no fear of conquerors or competitors? Have not the Chinese been awakened during the last few decades by the influence of Westerners? Has the retardation of Chinese civilization anything to do with heredity?

A PHILOSOPHICAL PEOPLE

The Chinese are proverbially known as a moral people, so it is rather unnecessary to dwell any longer to prove that they are a superior people morally.

A CHINESE FARM

China is better known for her urban arts, many of which are parasitic in character, than she is for her agriculture. We do not often consider how her teeming cities and crowded market places are supplied with food. There are no large tracts of land cultivated as a unit, as is done under our extensive methods. Each farm is worked by the farmer and his family, who themselves do most of the work, as there are very few draft animals. This picture was taken from the wall of Nanking, looking toward the city. (Fig. 1)

Nevertheless all human minds need constant reminding, so a consideration of the "philosophical people" may here be made. For forty centuries the Chinese have been followers of their philosophy of peace and industry; they are always practising and preaching peaceful justice—a noble idea which was gradually recognized by the leading thinkers of the world. Their filial piety, friendship, loyalty, and amiable character are perhaps unsurpassed. But most foreigners are familar only with the Chinese merchants abroad, and consequently they draw misleading observations and conslusions. The writer does not mean to state that such merchants do not represent the Chinese, but he only wants to make it clear that they represent only one class of Chinese. Students of biology and sociology agree that city life is detrimental to human physique and morality, so there is no wonder that even the Chinese gamble or fight "tong wars." It must be remembered that most of them are deprived of home life, and have absolutely no such pleasure and refreshment under the category of "social life." Yet the Chinese merchants in the Philippines, Hawaiian Islands, the United States, or elsewhere on the globe, morally are second to none. It seems to the writer that the reason why the Chinese are often hated, despised and ridiculed by those who are not well

A GIANT CHINAMAN

This man is one of two gigantic brothers who are doorkeepers at the government experiment station northwest of Peking. He is very sensitive about his great size, and refused to be photographed, even the director's orders proving ineffective. When invited to stand for his picture with the director and the American visitor the giant was too polite to refuse. The other brother is somewhat shorter. While these men are of exceptional size, they nevertheless serve to remind us that there are many people of no mean stature in Northern China, particularly in the district in which these brothers were born. (Fig. 2.)

informed is simply this: That "man carries his bag of faults on his back"; he always sees the faults of others but seldom his own.

According to the reports of the missionary schools in China, and to the mental measurements of the Board of Education of the Hawaiian Islands, the average Chinese school child is just as able as the American. The high scholarship of the Chinese students in American colleges is well known; the writer had the pleasure to hear from one of his professors, "My Chinese students are always the best!" It is true that the Chinese have not yet made any great contribution to pure sciences, but this is due to a lack of scientific environment and not due to deficiency in heredity. Such prominent biologists and eugenists as East, Castle, Holmes, Popenoe, and Johnson have time and again declared that the Chinese are by no means mentally inferior to any other

people, yet many foreigners think that the Chinese are only fitted to be cooks or laundrymen!

Physically the Chinese are shorter and thinner than the Teutonic people on the average. But the Chinese are a mixed people of many sub-races, so their weight or stature may vary from the highest to the lowest, just as does the American. Travelling writers and moving picture producers, having for their sole purpose financial success, have often too grossly exaggerated the queer Chinese physique and personalities in order to please their reader or audience. Alas, the majority of the world has too often been ruled by illusions! There is little doubt that Chinese school children are not so well developed physically as the American, but this is due to the fact that physical education in the Chinese schools is poorer, and not to inherited deficiencies. If any one has seen the well developed physique of the Chinese farmers with their marvelous rigidity and durability, he will be convinced that the Chinese are not weak physically.

SOCIAL AND POLITICAL STANDARDS

We can be assured, then, that the Chinese people are not weak morally, mentally, or physically; but how about their social or political abilities? The social and political standards are determined by history and tradition rather than anything else. They are the results of the tastes and dreams of the people. So if a people changes its tastes and dreams, the social and political standards are changed accordingly. Judging the present Chinese society and government by western standards, they do not measure up very well, but one must know that the Chinese for forty centuries have had and will have forever their peculiar tastes and dreams. They must be judged by that standard. The Chinese are now undergoing a transitional period; they are trying to adapt themselves to the best arts of the western civilization according to their own ways and conditions. America took more than half a century to develop a strong central government, and "Rome was not built in a day." But despite all the difficulties the Chinese people have had to face, their social and political progress during the last decade has perhaps not been duplicated anywhere at any time. As mentioned above, history is the best measure to ascertain the hereditary ability of a people; is there any place since man has kept his record, where he has had a longer and more peaceful and prosperous life than in China?

The reader might now ask, since so much has been said about the good points of the Chinese heredity, "why don't you tell *why* it is so?" This question may be answered briefly by the following:

(1) The modern Chinese are derived from the mixing of many highly endowed tribes.

(2) In an over-populated country like China natural selection in the form of diseases and famines has been very severe.

(3) There are many Chinese religions or customs which are eugenic, such as ancestor worship, large family system, early marriage, etc.

(4) There is a predominant rural population—85 percent according to the best available statistics—and the farm is the best habitat for human beings.

The Chinese are, therefore, justified in being proud of their heredity. They have led civilization in the past, and they will contribute much in the future. What they need is self-confidence, and recognition of their good heredity by others. They should learn all that can be adapted from the western civilization, yet at the same time preserve and develop what is best in their own.

A. N. JONES—PLANT BREEDER

SOME REMARKABLE RESULTS IN HYBRIDIZATION AND ROOT SEPARATION

IDA JONES RICHMOND
Batavia, New York

MR. A. N. JONES of Batavia, N. Y., began his work in hybridization in 1869 at LeRoy, N. Y. By 1876 he had secured, by crossing seedlings, many promising hybrids of the potato and the strawberry. Among these were the Early Gem, Genesee County King, and Tioga potato, and the Laural Leaf strawberry, still found growing in his garden true to type. The Amber Cream sweet corn was originated in these early days, being catalogued first in 1879.

In 1878, Mr. Jones began his work in cross-fertilization of wheat, then considered a most difficult plant to cross. In this work he secured many hundred distinct hybrids of winter wheat. Careful selection was practiced and only those of marked excellence or distinct difference were introduced to the seed trade of the United States and Canada.

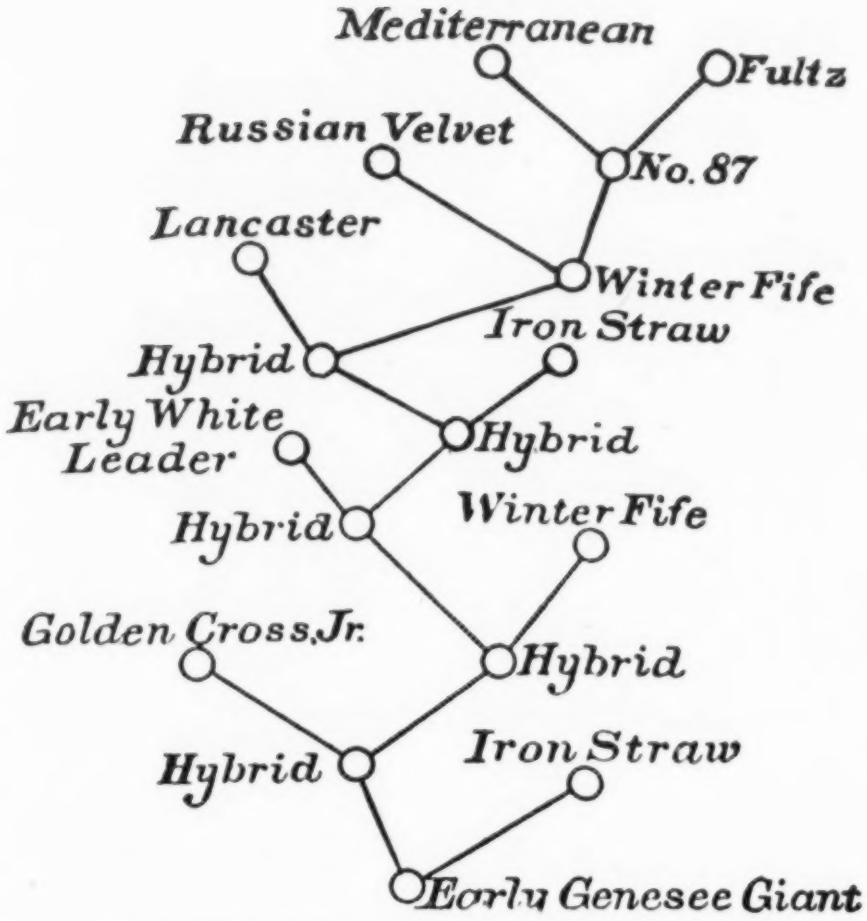
Mr. Jones, in an elaborate series of experiments in his plats, demonstrated the tendency of certain characters to perpetuate themselves. At that time comparatively little was known concerning the facts of inheritance. "Mendel's Law" formulated in 1865, by Gregor Mendel, an Austrian Monk who had experimented extensively with garden peas, was not known by the world at large. In his experimental work Mr. Jones evolved his own method of which he was justly proud. I am confident that dominance, segregation, and recombination were observed by Mr. Jones and were impressed upon his memory by hundreds of his own experiments. In all his cross-breeding he realized the importance of heredity; the "silent force which acts without expense" but so steadily, so surely. The pedigree of all his named varieties was worked out with infinite care and precision; note that of Early Genesee Giant as it appears in "the Basis for the Improvement of American Wheat" by Mark Alfred Carlton, Bulletin No. 24, Division of Vegetable Physiology and Pathology, U. S. Department of Agriculture. (Fig. 4).

In 1886, he introduced to the trade his first named wheat hybrid, Golden Cross, this being a cross of Mediterranean and Clawson. This was followed in 1888 by two other named varieties, New Early Red Clawson (a cross of Golden Cross and Clawson) and Jones' Square Head (a cross of Landreth and an unnamed hybrid) known in Canada as Harvest Queen by permission of Mr. Jones. These three varieties proved to be the vanguard of a series of wheats introduced over a period of years. In 1889 the first of Mr. Jones' hard gluten sorts, Jones' Winter Fife was sent out. Of this he had great hopes and said: "It is a boon to farmers and millers." This variety resulted from composite crossing of No. 87 and Mediterranean. In 1919 it was estimated by the U. S. Department of Agriculture that nearly half a million acres of this variety were grown in the United States, principally in Washington, Illinois, Missouri, Indiana, Idaho, and Montana in the order named. (Fig. 6.)

In 1889 he wrote as follows, "My most successful cross-breeding has been from combination (composite) crossing, as in crossing Mediterranean Longberry upon American wheat, progeny of which is crossed with Russian Velvet. A smooth chaffed wheat is sometimes used, progeny of which is again crossed with American wheat. This cross gives a strong healthy growth, deep root, thick walled stocky straw,

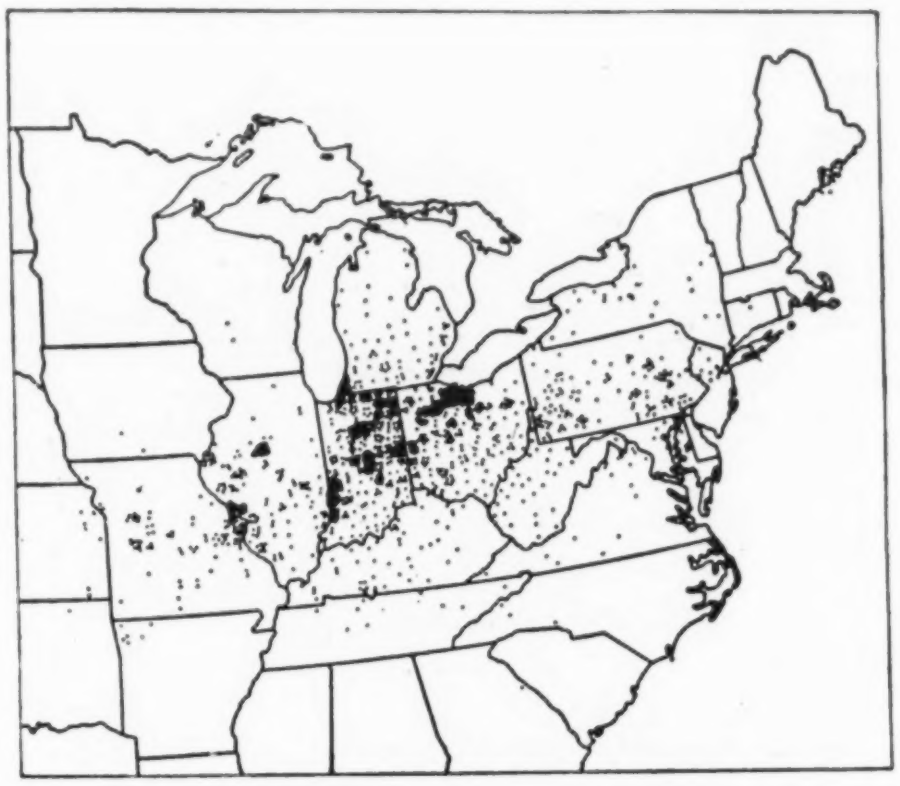
MR. JONES INSPECTING A PLAT OF HYBRID BEANS

In addition to developing over a score of wheat varieties of great economic value Mr. Jones did a great deal of work with beans, and introduced many important varieties. Some idea of the persistence and keen powers of observation required in this work may be gained by calling attention to the fact that Mr. Jones had as many as 1500 strains of hybrid wheat and beans growing in his experimental plats in one year. From this great number of hybrids grown each year, 50 or possibly 75 were selected as being of economic importance in the course of 35 years intensive work. (Fig. 3.)



THE GENEALOGY OF A FAMOUS WHEAT

Here the complexity of the plant breeder's work is somewhat visualized. From this series of crosses Jones' Genesee Giant was derived. No indication is here given of the great number of unsuccessful crosses made at the same time. Mr. Jones was able to hasten the development of desirable kinds by the process of root separation; from a single seed sown in August 1888, 27 pounds of wheat were harvested the following summer. (Fig. 4.)



THE DISTRIBUTION OF JONES' RED WAVE WHEAT

In 1919 more than a million acres of Red Wave wheat were grown in the United States. On a basis of ten bushels per acre, at $2.50 per bushel, the crop was worth twenty-five million dollars. Had the originator received a royalty of only one hundredth of one percent, he would have an income of $2,500 from this variety alone. On such a basis the originator of two or three varieties of commercial importance would be financially independent, and able to give his whole time, and an unworried mind to his work. (Fig. 5.)

and grain of a fine milling quality in a compact head."

In 1890, No. 8, or American Bronze, a variety adapted to poor or light land was catalogued. This hardy sort was a parent of some of the most desirable later varieties. Two superior varieties appeared in 1892, Early White Leader and Early Genesee Giant. The first mentioned was the result of a complicated composite cross, and was pronounced by millers "one of the whitest flour-making sorts grown."

In all his cross-fertilization of wheat Mr. Jones aimed to accomplish certain definite results, viz., to originate varieties best suited to a given soil; those best suited to certain climatic conditions; to secure increased size of spike and strength of straw; to secure those immune to attack of weevil and rust; and also to secure high gluten content.

In 1893, Mr. Jones removed to Newark, N. Y., in order to test the effect of change of soil upon his breeding stock. Pride of Genesee, having for one parent the old reliable Jones' Winter Fife, was introduced in 1893. It was named for the County in which it was originated, as was Early Genesee Giant.

In 1894, three new varieties were listed in the United States and Canada, (1) Bearded Winter Fife, a variety believed to possess increased gluten content, (2) White Seeded Golden Cross, recommended for dry or gravelly soil, and (3) Long Amber, recommended as "The Ice and Waterproof" wheat. These were all results of composite crossing of Mr. Jones' hybrids.

Early Arcadian introduced in 1895 was a beautiful wheat named for the town of Arcadia, N. Y., in which it was originated. It was a cross of Early Genesee Giant and Early Red Clawson and partook of all the good qualities of both parents.

In 1896, Oatka Chief, a wheat recommended for cobblestone land such as is found in the lake region, appeared. It was given the Indian name for its place of origin on the bank of the Oatka.

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From this great number of hybrids grown each
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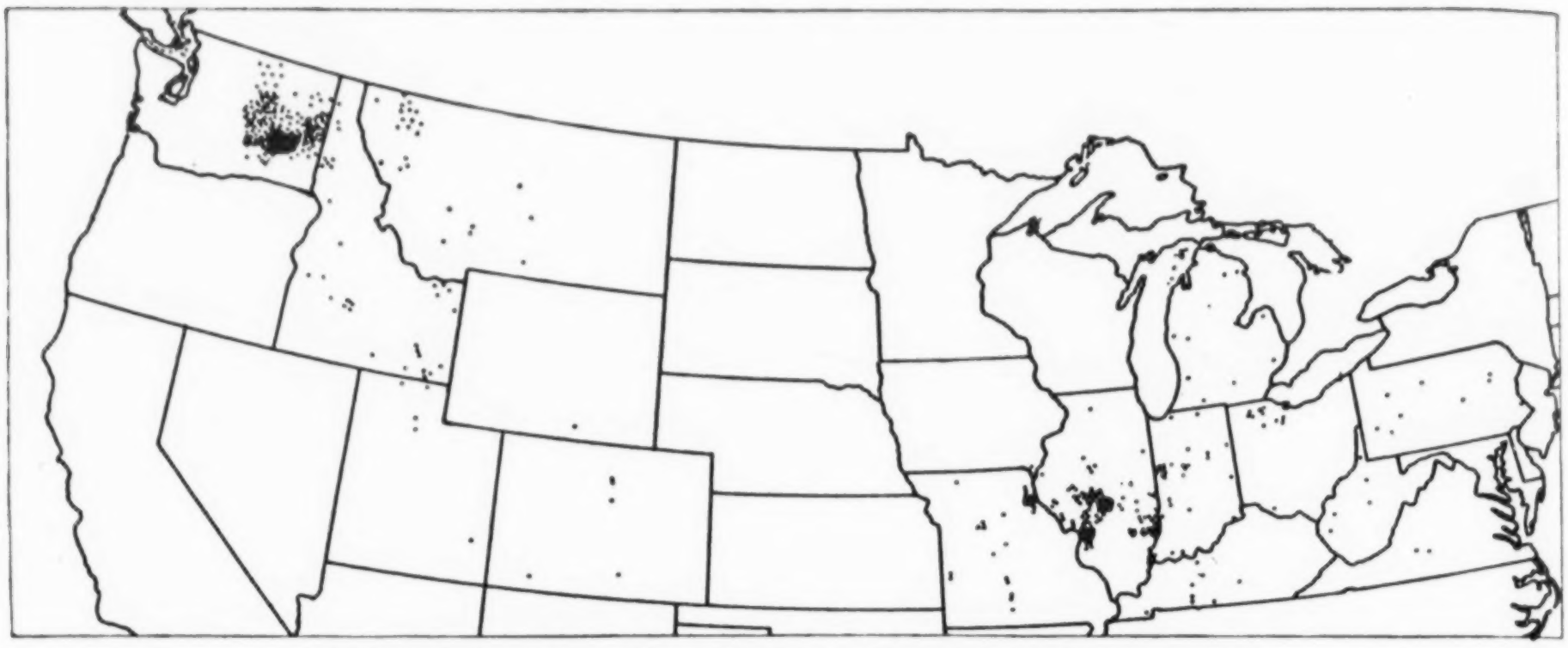
in the course of 35 years intensive work. (Fig. 3.)



DISTRIBUTION OF JONES' WINTER FIFE WHEAT

Mr. Jones considered this the finest of his hard gluten varieties. More than half a million acres were planted to this wheat in 1919, the year for which this map was made. Although it is one of Mr. Jones' earlier introductions, dating from 1889, it is still an important and widely grown variety. (Fig. 6.)

Diamond Grit or Winter Saskatchewan was also introduced in this year. In Diamond Grit he believed that demand for high gluten content was met, for he wrote of it, "It is a worthy rival of the hard spring wheat of the Northwest."

In 1897, Early Red Rover and Jones Longberry No. 1, both most promising varieties, were listed. The latter was the result of several years' experiments in crossing this Longberry type. This sturdy sort made a record of 54½ bu. per acre, sown Sept. 22, on light cobblestone land, and in plat, of 63¼ bu.

Longberry Clawson of 1899 was also a result of composite crossing. It was adapted to strong clay loam, and upon such soil was inclined to club headedness. Mr. Jones had many hybrids having this form of head but owing to limited demand for such, few were sent to the trade. From examination of old breeding stock I find none with less than 60 grains to the spike in these varieties with club square head.

Jones' Early Red Chief of 1902 originated in the historic Seneca Indian region and this sturdy red progeny was named accordingly. Of it Mr. Jones wrote "It is strong at all points." Silver Sheaf Longberry (a cross of No. 8, Lancaster, and No. 91 Longberry), was first listed in 1902. This has a flinty grain almost as long as rye.

A plat of Paris Prize of 1904 was grown on the exposition grounds at St. Louis and attracted much attention. The spike of this wheat is immense, as is that of Mammoth Amber of the same year. Mr. Jones' exhibit of 500 hybrid wheats at the Pan American Exposition was awarded the Gold Medal and his exhibit at St. Louis won the Grand Prize. Mammoth Amber was one of the 43 crossbred wheats sent by Mr. Jones to Paris Exposition, 1900, in charge of the U. S. Department of Agriculture, and awarded the Gold Medal.

In 1906 Red Wave was introduced. It has an unusually long spike sometimes measuring 5½ to 6 inches. The U. S. Department of Agriculture estimates that over a million acres of this variety were grown in 1919. (Fig. 5.)

St. Louis Grand Prize of 1908 was a progeny of a new Russian wheat crossbred with a seedling. It was thought to be practically "fly proof" and was called a rough and ready sort.

The entire stock of Jones' Climax and a new Club head was sold in 1914. An observer said of the former variety "A field of the Jones' Climax is about as fascinating a sight as human eyes can look upon."

The above varieties comprise the list of authorized introductions of the Jones' wheats, with the exception of

an unnamed stock sold to a firm in Canada. It is possible others reached the seed trade in devious ways. Mr. Jones was of the opinion that No. 6, a variety widely grown in New York, was really one of his wheats.

Had Mr. Jones been less conservative, or had he been able to increase stock sufficiently fast, he could have introduced a score of varieties each year instead of from one to three as was his rule.

EXPERIMENTS IN ROOT SEPARATION

It was seldom he could practice root separation to a great extent in propagating his strains as it required more time and space than he could give it. His most notable experiment in 1888, created much interest. The soil of the experimental plat was prepared a year in advance and the surface was kept mellow. July 12th he planted one kernel of Jones' Winter Fife wheat. July 31st he separated the root, making four hills from the side shoots. August 17th he divided again making 15 roots from the four. Sept. 4th he obtained 75 roots and by Sept. 24th these were increased to 300. Oct. 10th there were 505, October 31st they had increased to 900. Nov. 22nd he divided again having 1140 roots. Thirty-six of these winter-killed leaving 1104. Some of these had from 18 to 24 large heads. From this plat 27½ pounds of wheat was threshed. Mr. Jones wrote of this as follows "The grain was very plump, bright and heavy and would have taken first premium at any agricultural exhibit."

From such small beginnings came the splendid hardy wheats that in a few years covered thousands of acres of our land.

BEAN BREEDING

At one time his trial plats contained more than 1500 hybrid wheats and beans. Among the latter were the following named varieties sent out to the trade: Jones' Ivory Pod Wax, 1881; Lemon Pod Wax, 1881; Jones' Round Pod Wax, 1898; Golden Crown White Seed Stringless Wax, 1899; Garden Pride Stringless Green Pod, 1902; Green Pod Stringless, 1902; Jones' Marrow Pea, 1909. The Jones' Ivory Pod Wax was a parent of many of the later sorts.

As Mr. Jones never delegated to others any important work connected with his experimental plats it is readily seen how much work he accomplished. Possibly his heritage from sturdy English ancestors enabled him to endure this painstaking labor for thirty-five years.

BIOGRAPHICAL

Mr. Jones was born in 1843, at Cookham, situated upon the Thames River, England. At the age of five years he came with his family to America, and located in Rochester, N. Y. The three Paper Mills at the Lower Falls were later owned by the Jones Bros. when much of Main Street was a common. None of the processes of the trade of his youth were of use to him in his chosen work, with the exception of finishing, which at that time was done by hand, and required a certain dexterity in counting, best learned in early youth.

The secret of his ability to produce such a great number of desirable hybrids is found in his unbounded enthusiasm, unlimited patience, painstaking care, and absorbing love for his work.

A New Approach to Eugenics

IS AMERICA SAFE FOR DEMOCRACY? by William McDougall, professor of psychology in Harvard University. Pp. 218, price $1.75. New York, Charles Scribner's Sons, 1921.

In a most readable and fascinating book, Dr. McDougall brings some of the data of anthropology or racial psychology to bear on the problem of eugenics. He starts with the question whether there are innate, germinal differences between the people of different races. Suppose for a given period all the English and French babies born could be exchanged in their cradles; would the subsequent history of the respective countries, and their literature and institutions, undergo a marked change? To arrive at an answer, he starts by an analysis of the art of different nations. This he supplements by examining some other fundamental traits, and draws a picture of the Nordics, characterized by a relatively high degree of curiosity, self-assertiveness, alcoholism, tendency to suicide, protestantism in religion, and a high divorce rate, as contrasted with the Mediterraneans, who are more gregarious, free in expression of their emotions, submissive, and Roman Catholic in their religion. These qualities are largely reduced by the author to a single fundamental constitutional difference: the Nordics are prevailingly introvert, the Mediterraneans extrovert. The Alpine race, he thinks, occupies a position somewhat intermediate. The consequences of these constitutional differences are so far-reaching and unmodifiable, the author believes, that the imaginary replacement of English by French babies, above alluded to, could not fail gradually to result in transposing the institutions and customs of the two nations. The moral qualities are, in their origin, likewise innate, Dr. McDougall believes, and he rightly lays great stress on their importance in racial history. He believes that the valuable and irreplaceable Nordic qualities are already well on their way to extinction in England, and that a similar result is imminent in the United States, due to the race suicide of the possessors of the traits. His principal suggestion, in the way of remedy, is for the institution of a wage-scale in all public offices, whereby salaries would be increased in proportion to the size of family of the office-holder. He also advocates the public registration of family histories. —P.P.

Books Received

The Population Problem, by A. M. Carr-Sannelers, The Oxford University Press, New York, 1922.

Foundations of Biology, by L. L. Woodruff, The Macmillan Co., New York, 1922.

Why Die so Young?, by John B. Huber, Harpers, New York, 1922.

Hormones and Heredity, by J. T. Cunningham, The Macmillan Company, New York, 1922.

The Minds and Manners of Wild Animals, by William T. Hornaday, Charles Scribner's Sons, New York, 1922.

EDUCATIONAL ANTHROPOLOGY

By Arthur MacDonald
Washington, D. C.

IN GENERAL, the introduction of new words or terms into a language should be discouraged, but when they indicate a new direction or application of thought, they may prove serviceable, especially if they tend to more *scientific* methods. Educational anthropology is a study of mental and physical life, as applicable to educational forces, just as educational psychology is an investigation of mental life in connection with similar forces. That is to say, while educational psychology deals mainly with the mental, educational anthropology is concerned with both the physical and mental, with emphasis on the moral, especially in connection with criminal anthropology, popularly called "criminology." That is, moral education is most important; otherwise, what is the use of educating the young and having them graduate into prison, as so many do? Educational anthropology refers to modern civilized man, rather than to savage and prehistoric man, and is of very recent date. A proof of this is the fact, that the first scientific study ever made of a human being was that conducted upon Emile Zola by some twenty French specialists in anthropology, psychology, and medicine. This was published in 1897.[1]

RELATIONS OF EDUCATIONAL ANTHROPOLOGY

Education may be defined, in a simple way, as the process by which a community and person are brought from where they are to where they ought to be. Where they are and where they ought to be at every period of their physical and mental development, are questions of educational anthropology. We may also define education as the process by which the ideas, institutions, and habits of civilization are handed down to the new born and to the young. That is, education is the process of *social heredity*, as distinguished from germ heredity which relates to inborn native tendencies, coming from our ancestors.

Education may consist of all the processes by which a community transmits its acquired power and purposes, in order to continue its own existence and growth. Society is made up of the young and inexperienced and of the old and experienced. Since the old will soon die, the new born and younger members must be so reared and educated, that they will appropriate the functions and values of the old. The physical and mental processes of growth, if not directed, cannot maintain the habits and ideals in vogue. That is, the institutions and customs of civilization cannot be maintained except by social heredity, by deliberate educational processes applied to the young. Otherwise civilization would cease.

The higher the civilization the greater the difference in level between the new born and the aged, and this widening gap increases the necessity for education as the main condition for the preservation of civilization.

Educational anthropology must find the biological equipment for affecting growth and development in both the child and the community. Hence the increased attention given to eugenics, to child study, to the problems of normal, accelerated, and retarded growth. Here anatomy of the brain and school hygiene assume much

[1] The author has made a summary of this study in his work entitled "Juvenile Crime and Reformation," Senate Document No. 632, 60th Congress, 1st Session.

importance, due to the social interest in anatomical and physiological characteristics of man, especially in connection with educational institutions.

Educational anthropology depends much upon medical data, especially as related to physical education and school hygiene, as the study of growth in children. It emphasizes the importance of knowledge of the child, as a basis for all teaching, in addition to a knowledge of the subject matter of instruction.

The growth of children has assumed much importance in education. Here educational anthropology considers not only the establishment of age standards, but the correlations of growth, ability, and physical and mental development. The measurements of children of the same age show different physical developments, which increase as the age increases. Thus the processes involved in learning to read, spell, and write, require an educational anthropologic analysis, and the physical and mental tests at present so dominant are included in this analysis.

Educational anthropology on its ethnological side is closely affiliated with the history of civilization. It helps to develop the idea of the evolution of modern society from primitive forms, suggesting that the development of a child should follow, to some extent, the manifestations of life of primitive peoples.

Educational anthropology, like educational psychology, includes the selection and organization of anthropologic data of practical service to teachers. Education has two general purposes; one is to train and develop the native tendencies, and the other is to transfer or hand down to the young the results of civilization. This transfer is the process of learning. The study of this process by which the physical, mental, and moral acquirements of civilization are given to the young, is an educational anthropologic problem. This process of transference depends upon methods of learning and the capabilities of the pupil. In connection with this process, educational anthropology treats of the activity and development of body and mind with certain prescribed ends in view. These ends or results, serve as tests by which the success of the educative process is to be measured. Thus much of the material for educational anthropology consists in methods of learning as illustrated and applied to school work.

EDUCATIONAL ANTHROPOLOGY AND RURAL EDUCATION

Educational anthropologic study, which includes mental and physical tests as applied to rural schools, concerns also educational psychology in all its phases. In general, the scientific study of children, adolescents, and adults, both mentally and physically, in relation to all kinds of education, comes under the head of educational anthropology. Its scope is obviously very large, and it would take too much time and space at present to deal with its relations to the many branches of education. It may, however, be useful very briefly to consider the relation of educational anthropology to some of the more recent phases of education, as rural and industrial education, and also physical education and school hygiene.

Many years ago, the author had some experience as a teacher in rural schools. As he now looks back, it becomes painfully evident how much such schools were neglected; and at present they need the advantages coming from the scientific study of school children, which educational anthropology in its various branches can present. All anthropologic studies of school children, including physical and mental tests of them apply, of course, to rural education.

One of the difficulties the author found in rural schools was the physical uneasiness and restlessness of the large boys in winter time. They could not sit still long, nor keep their attention under control, so that they did not study very much, although they were not lazy; for they were all hard workers on the farm. One of them said,

"How much more difficult it is to sit still and study than to do the hardest kind of farm work." It is physiologically unnatural to make children, or larger individuals, sit still a relatively long time, for children are normally very active, and these boys were accustomed to hard physical labor. In general, all education is physically unnatural to a certain extent. If we left the children alone, they, of course, would become little barbarians, though doubtless stronger and healthier physically. But they would not be adapted to modern life. So the problem is to employ such educational methods as will make individuals best prepared for the duties of life, without taking too much from their physical well being; that is, the purpose of educational anthropology in rural education is to find the golden mean between the physical and mental life which will be best adapted to rural life.

SCHOOL HYGIENE AND PHYSICAL EDUCATION

There is already much literature on school hygiene in medical, psychological, and anthropological periodicals. It is based principally upon medical and anthropological studies, such as anatomy and physiology, in connection with influences that act injuriously upon organs and their activities. Intelligent knowledge of hygiene is almost impossible without familiarity with anatomy, physiology, and pathology, the bases of the subject, which are best obtained by a medical education.

Hygiene of the school child deals with the character of the child's body and also the laws of growth, and seeks to determine methods of avoiding the dangers inherent in each stage of physiological and psychological development. Hence, important contributions to school hygiene have been made by the many scientific studies of growth and development, of the diseases and abnormalities of school children. The relation of the physical development of children to intelligence, the incidence of diseases by years, grades, and seasons, and the relation of defects to school progress are some of the most important questions in school hygiene. Also medical inspection of schools is a basic study under the head of school hygiene and physical education.

The psychology of instruction also shows the importance of mental habits formed by education. The study of fatigue, for instance, with anthropological instruments of precision is of practical importance in determining the length of periods of work and rest, study and recreation. The development of healthy habits, mental activity, self-control, and concentration are practical features of anthropological studies showing the hygienic importance of mental training and activity.

COURSES FOR STUDENTS IN EDUCATIONAL ANTHROPOLOGY

Since the scientific study of modern man requires the aid of many specialists, it is evident that no one person can go into all the phases of the subject in detail, but may consider only their general relations. In view of this fact, what preparation is requisite to undertake investigations in educational anthropology?

When a student chooses for his life work a subject in the older branches of knowledge, as physics, philosophy, philology, Greek, Latin, or natural history, he finds the field well developed; but this is not so in the more modern branches of research, such as educational anthropology, and other cognate subjects. In these fields there is abundant opportunity for mental acumen and scientific ability of the highest character to help carry out moral educational ideals.

The question may arise as to what courses of study will best prepare one for such work. The following post graduate plan of studies is suggested:

1. Courses in general anthropology, ethnology, and history of civilization.
2. Courses in general biology, evolution, genetics, and eugenics.
3. Courses in psychological laboratory work.

4. Medical studies in anatomy, craniology, physiology, general pathology, nervous diseases and insanity, especially clinical studies.

5. Modern languages.

Thus educational anthropology requires more extensive preliminary training, perhaps, than any other subject, for it involves the investigation of man both mentally, morally, and physically. Such training is comprehensive, which in this age of specialization is much needed. At least a few students should be trained to combine and utilize cognate branches of knowledge. They should know enough of such branches properly to interpret the results obtained by specialists. Since such education is relatively new and experience in it is, as yet, limited, it is difficult to designate preparatory courses more definitely than has been done above, as only general suggestions are feasible at present.

PUBLICATION OF SECOND EUGENICS CONGRESS PROCEEDINGS

THE following communication has been received from Dr. Charles B. Davenport in regard to the publication of the Proceedings of the second International Congress of Eugenics:

Those interested in the Second International Congress of Eugenics held in New York City last autumn will be pleased to learn that arrangements have been made with Messrs. Williams and Wilkins of Baltimore by which they are to publish the Proceedings. These are to be printed in two volumes: I, "Eugenics, Genetics and the Family" and II, "Eugenics in Race and State." Besides the numerous papers there will be published in the books a series of about 60 full page photographs, reproducing a considerable part of the exhibit. Prior to publication the publishers offer the two volumes at $9; after publication $11. It is suggested that persons who desire to secure these volumes should write at once to the publishers, to be entered for the set at pre-publication price.

Besides the more general addresses of Osborn, Leonard Darwin, Davenport, Cuenot, Lucien March and De la Pouge there are special papers by the geneticists Jennings, McClung, Bridges, Blakeslee, John Belling, G. H. Shull. P. W. Whiting, H. J. Muller, C. Zeleny, A. F. Shull, A. M. Banta, H. J. Bragg, E. C. MacDowell, Sewall Wright, C. C, Little, C. C. Hurst, Helen D. King. More strictly eugenical papers are by physicians, statisticians and professional eugenicists such as Dr. Woods, Mrs. Ruth Martin, H. J. Banker, A. H. Estabrook, W. E. Key, Elizabeth Greene, R. H. Johnson. An analysis of the Oneida Community Experiment is given by two of the descendants of its founder. Inheritance of musical traits is considered by Drs. J. A. Mjöen, C. E. Seashore and Hazel Stanton. Race mixture is considered by Hooton, L. C. Dunn, Maurice Fishberg, W. F. Wilcox, F. L. Hoffman. The problem of population is analyzed by Raymond Pearl, E. M. East and Sir Bernard Malet. There are a number of important papers on anthropometry and development. The field of preventive eugenics is represented by C. W. Saleeby, R. A. Fisher, H. H. Laughlin and W. S. Sadler. Interesting papers on inheritance in relation to education, immigration and race betterment are included. The volumes include a number of portraits of eugenicists.

ZYGODACTYLY AND ITS INHERITANCE

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NORMAL WEBBED TOES

In certain early developmental stages the human foot is normally webbed. Very soon afterwards the webs disappear and the toes become separated. If this reduction of the webs fails to take place the condition of web-footedness results. Note that this normal pre-natal webbing is greater between the second and third toes than between the others. (Fig. 7.)

A SIMANG'S FOOT

Webbing occurs repeatedly between the second and third toes of these apes found in Borneo and Sumatra, and it is also found in other animals. It represents an arrest in normal development, in contrast to conditions like split-foot, characterized by union of the boney elements of the hand or foot, which are brought about by deep developmental disturbances. (Fig. 8.)

THE last two volumes of the JOURNAL OF HEREDITY each contains a report on the inheritance of web-formations between the second and third toes in man[1,2] and the writer has come across several other articles, scattered through the literature, in which this anomaly has been traced through a number of generations. It seemed desirable to collect these various studies, each of which was made independent of other recorded cases, in order to be able to draw wider conclusions from the larger material, to correct some slight misstatements made by previous authors, and to stimulate further collecting of such cases.

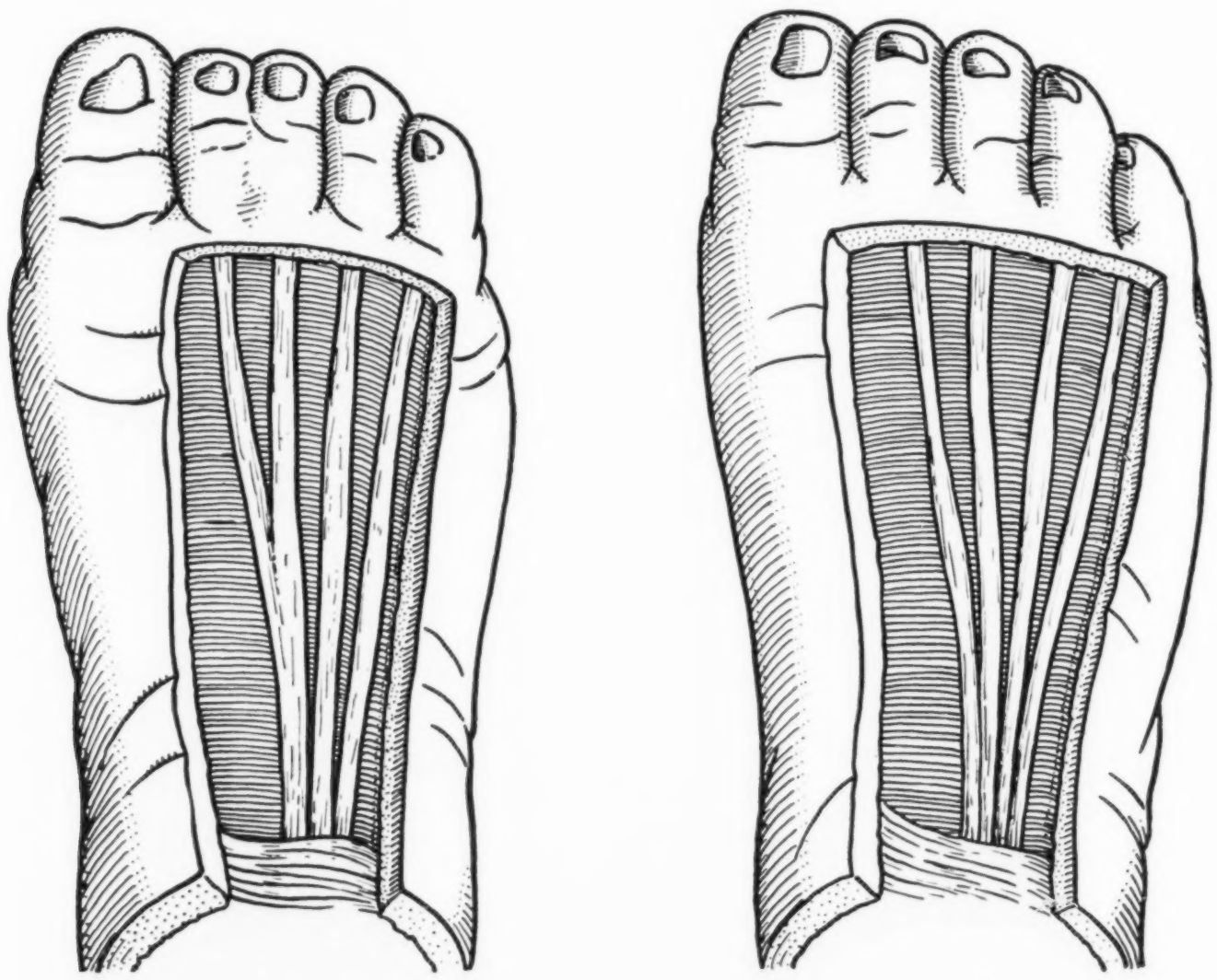
Before taking up the question of heredity, it might be well to consider in more detail the anomalous condition itself. In figure 7 is shown a very early developmental state of the human foot. From this it can be seen that during growth the toes pass through a phase in which they are normally joined by webs. Between the second and third toes this web-formation extends slightly farther than between any of the others. Very soon afterwards the toes become separated, i.e., the webs are reduced to

[1] Hurlin, R. G. 1920. A case of inherited syndactyly in man. J. OF HEREDITY, vol. XI, pp. 334–335.

[2] Schofield, R. 1921. Inheritance of webbed toes. J. OF HEREDITY, vol. XII, pp. 400–401.

ZYGODACTYL TOES

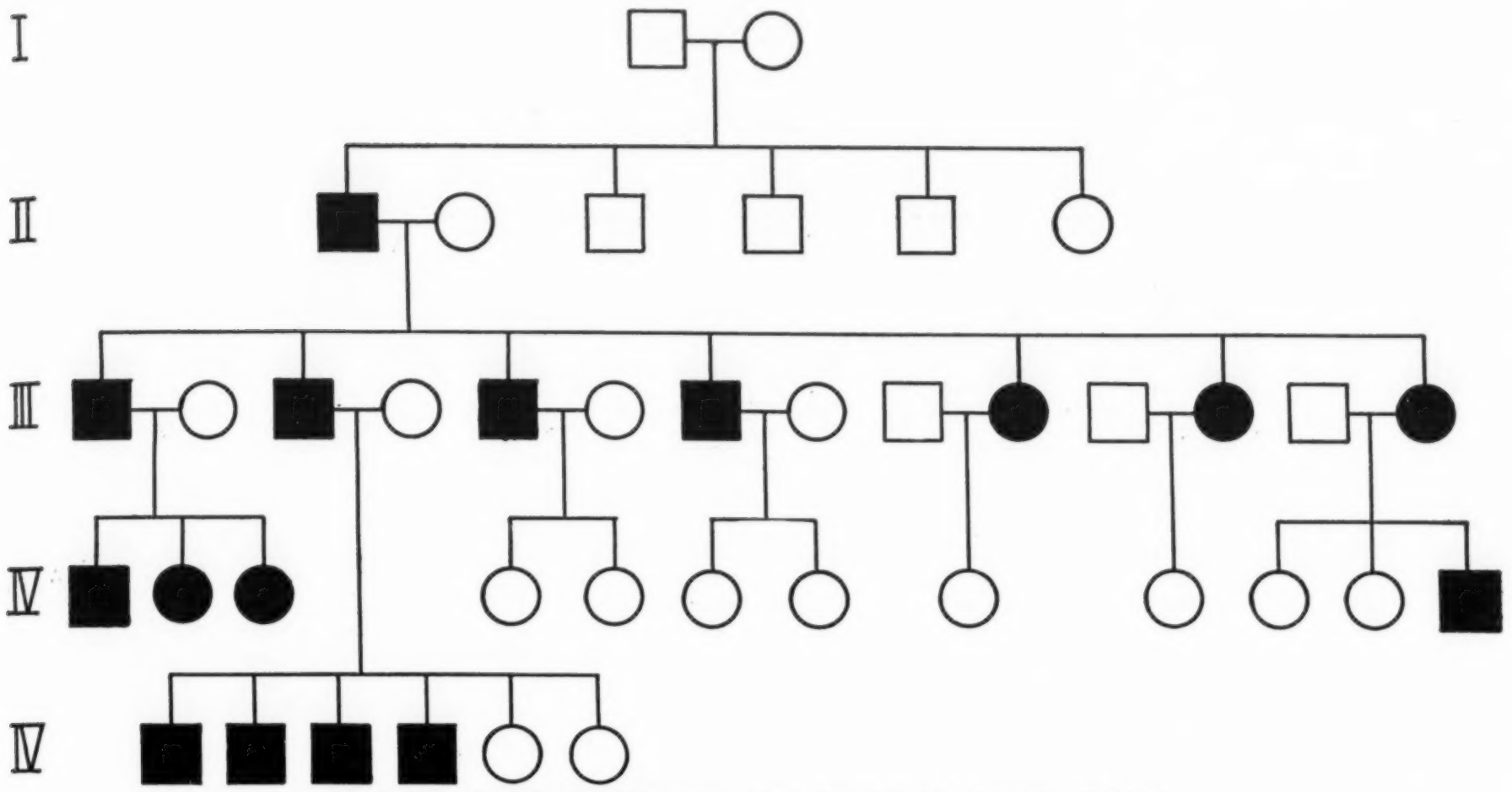
Zygodactyly, or union of the flesh between the toes occurs more often between the second and third toes than between any others. They seem to have a natural affinity for each other as indicated in Figs. 7 and 10. It is not a common condition; one investigator found only eight cases in examining 20,000 men. (Fig. 9.)



A. B.

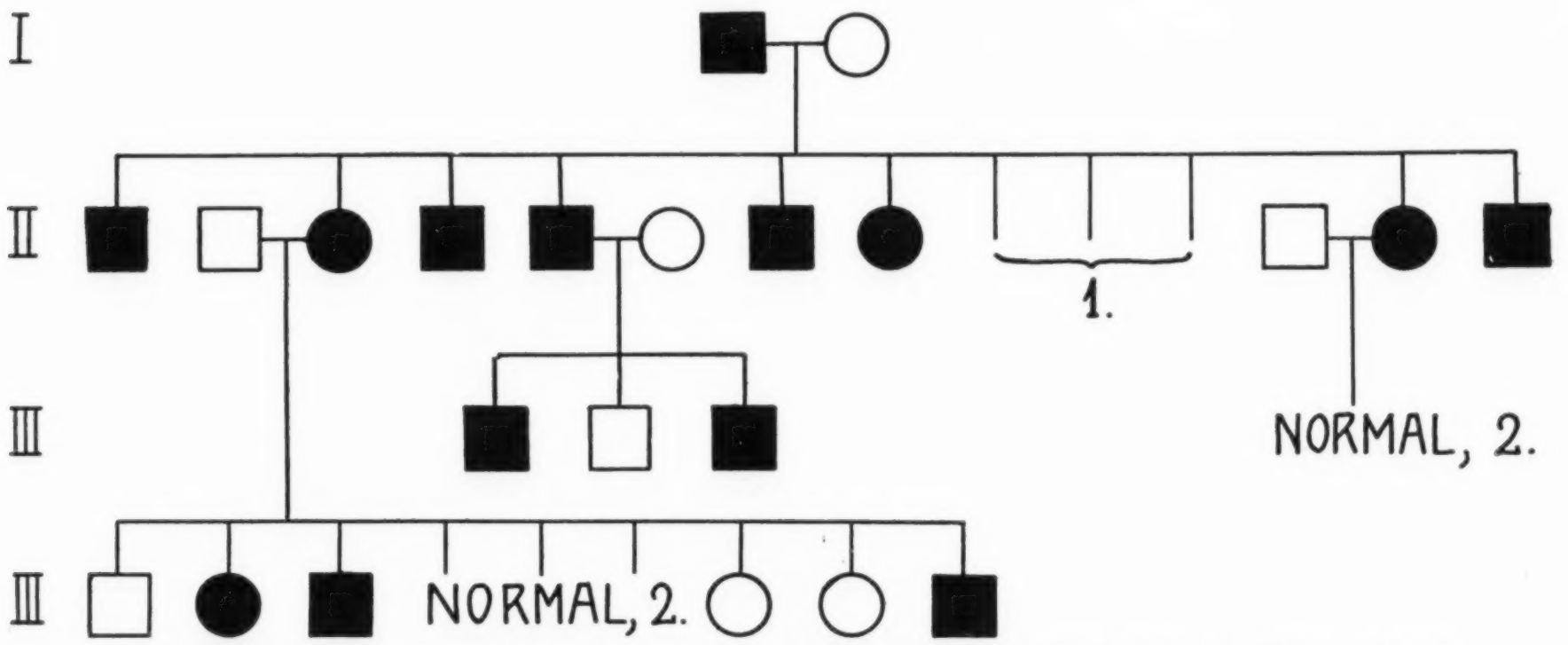
TENDONS UNITED IN ZYGODACTYLY

A shows the tendons connecting to zygodactyl second and third toes, B, the tendons in a normal foot. When the toes are webbed the tendons are united much farther along than is normally the case. Note that the tendons to toes II and III are normally united farther up than the others, pointing to a closer connection between these two toes. (Fig. 10.)



THREE GENERATIONS OF ZYGODACTYL TOES

The inheritance of zygodactyly between the second and third toes on both sides for three generations. In this family the character is more likely to be inherited by men than by women. Redrawn from Pfitzner.[3] (Fig. 11.)



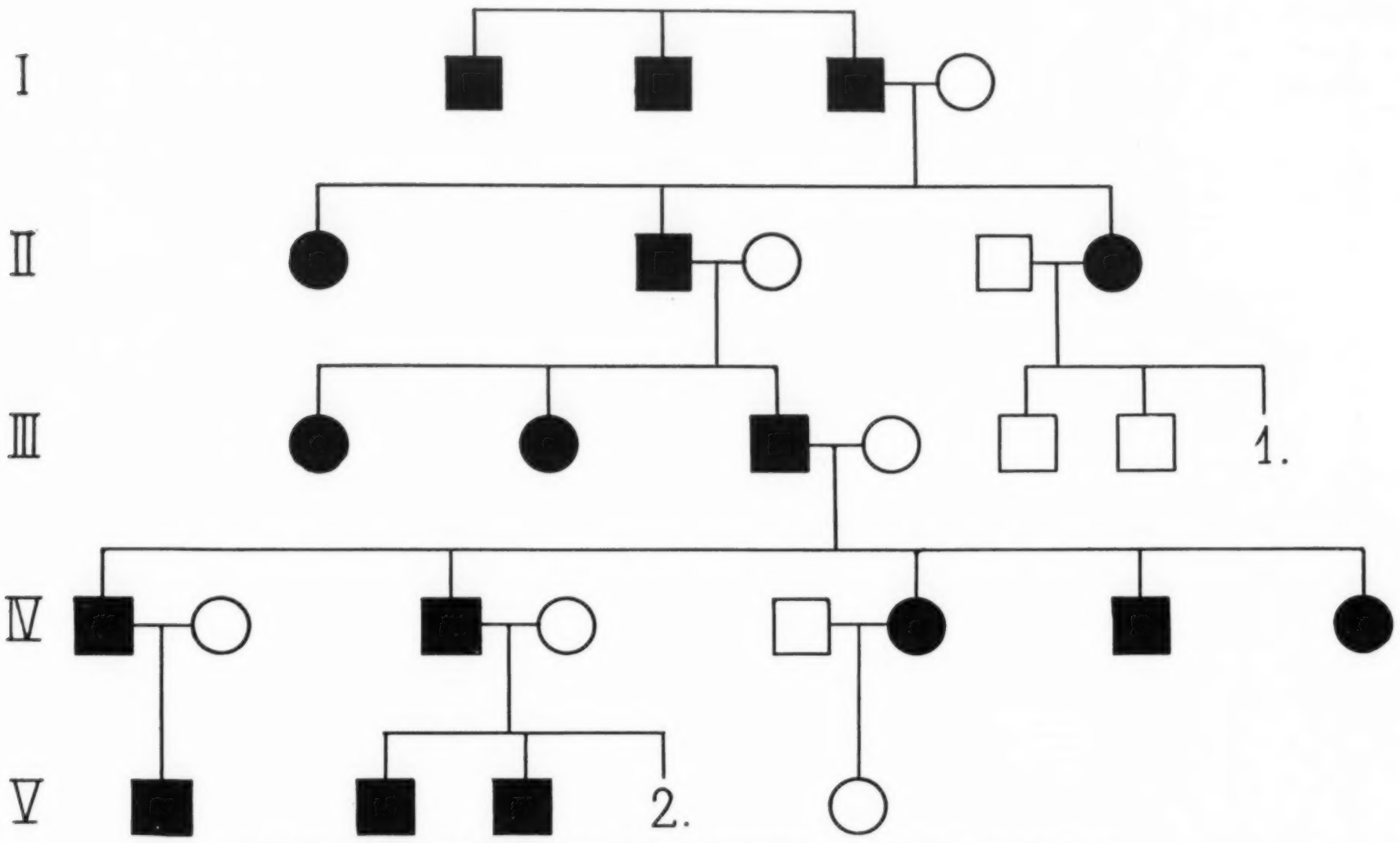
THE INHERITANCE OF ZYGODACTYLY BETWEEN THREE TOES

The first, second, and third toes on both feet are united by webs. Webbing between the fingers is frequently associated with webbed toes, and is a character that should be looked for in future investigations of zygodactyly. Redrawn from Wolff.[5] (Fig. 12.)

small remnants at the base of the toes. If this reduction does not take place, as in the few individuals with webbed toes recorded in the literature, it must be classed as a local developmental arrest.

The term "syndactyly" or "syndactylism" is commonly applied to this condition of webbed toes or fingers; however, the same name is given as well to the union of the bony elements of foot or hand and sometimes to the partial or complete lack of toes or fingers ("split-foot," etc.). These last mentioned anomalies are not an arrest in otherwise normal development, but are due to various deep developmental disturbances and are therefore genetically different from the condition described in this paper. Weidenreich,[3] in a recent paper, proposes to call the condition of webbed toes or fingers *zygodactyly* to distinguish it from all

[3] WEIDENREICH, F. 1921. Der Menschenfuss. Zeitschr. f. Morphol. u. Anthrop., vol. XXII, pp. 51–282.



ONLY THE RIGHT TOES WEBBED IN THIS FAMILY

Only the second and third toes on the right foot are united. (1) number of sons unknown, all normal; (2) number of sons unknown, all with webbed toes. In this case the character is sometimes inherited by the women, but it is only transmitted by the men. Redrawn from Sommer.[7] (Fig. 13.)

other forms of syndactyly, a suggestion which should be welcomed, in view of the differences in origin in the various types of syndactyly.

Zygodactyly is not restricted to man; it is found in many mammals, such as several groups of marsupials and in the Simangs, apes from Sumatra and the Malay Peninsula. In these animals skin-fusion between the second and third toes is a constant occurrence. Figure 8 shows this in a Simang in a late stage of prenatal development, proving again that zygodactyly is a congenital condition. In the large majority of the reported cases of zygodactyly of the human foot the fusion, as in the mammals just mentioned, exists between the second and third toes only. For instance, in the 8 individuals with zygodactyly, found by Schurmeier[4] among a total of 20,000 men examined, the anomaly occurred always between toes II and III. It seems highly probable, therefore, that these two toes possess a special tendency or predisposition to fuse. As shown above, in early development the normal webbing is more pronounced or persists slightly longer between these two toes than between the others. It is also known that the tendon for the long extensor muscle of the toes is split farther up between the third and fourth and fifth toes than between the second and third, another fact pointing towards a greater unity between the last mentioned toes. Weidenreich found in two adults with zygodactyly of these two toes that the tendons of the extensor digitorum longus muscle for toes II and III were in common, or unsplit, for an unusually long distance, i.e., to the middle of the dorsum of the foot. This finding was confirmed by the author in the case of a zygodactyl newborn (fig. 10).

A number of cases have been described in which zygodactyly between the second and third toes was associated with zygodactyly of varying degree between the third and fourth

[4] Schurmeier, H. L. 1922. Congenital deformities in drafted men. Am. J. of Phys. Anthropol., vol. V, pp. 51–60.

fingers (Roskoschny,[5] Wolff,[6] or between the first and second, fourth and fifth, or even between all the fingers (Pfitzner).[7] Such correlations between web-formations of foot and hand are of special interest and should always be carefully searched for in future records of zygodactyl toes.

Webbing between the second and third toes may occur only on one side in all the affected members of a family, as the family reported by Sommer,[8] in which it appeared on the right foot only; or the web may extend farther on the right than on the left side, as in the family recorded by Schofield, or vice versa, as in the case of Hurlin. Finally, zygodactyly of the foot is not restricted to the male sex and therefore is not a secondary sex character, as assumed by Schofield; it has been observed in a number of females as well. The writer, for instance, found it in a newborn girl, the zygodactyl feet of which are shown in figure 9.

The three charts given in this paper were redrawn by the author from reports found in the literature, showing the inheritance of zygodactyly. The original pedigrees were presented according to widely different methods, but in their present shape they will be found easier for comparison with one another and with the two charts recently published in this journal.[1,2] The following general conclusions in regard to the rules of heredity of webbed toes can be drawn from the pedigrees given herein, together with those by Hurlin and Schofield. It can be stated, first of all, that apparently in no zygodactyl family does the anomaly skip a generation; i.e., those individuals who are free of the condition, although of zygodactyl strain, will in all probability have only normal children. Another striking feature is the fact that the chance for the female to transmit webbed toes to her children is very much less than for the male. However, since this does occur, the conclusion by Castle[9] based upon the pedigree by Schofield, that webbed toes have the distribution in heredity of a Y-chromosome, is not borne out by our material. It also seems that female progeny is in general less apt to inherit zygodactyly than male offspring. How closely the condition is inherited is shown by the number of families in which an affected father transmits the defect to all of his children (Fig. 13: in all generations except where transmitted by females; Fig. 11: generation III and one generation, IV; Schofield: one generation, IV). Only when more pedigrees for zygodactyly have been recorded will it become possible to enlarge on these conclusions and at the same time to place them on a firmer basis.

[5] Roskoschny, F. 1918. Symmetrische Syndactylie beider Hände und Füsse. D. Mediz. Wochenschr., vol. XLIV, p. 350.

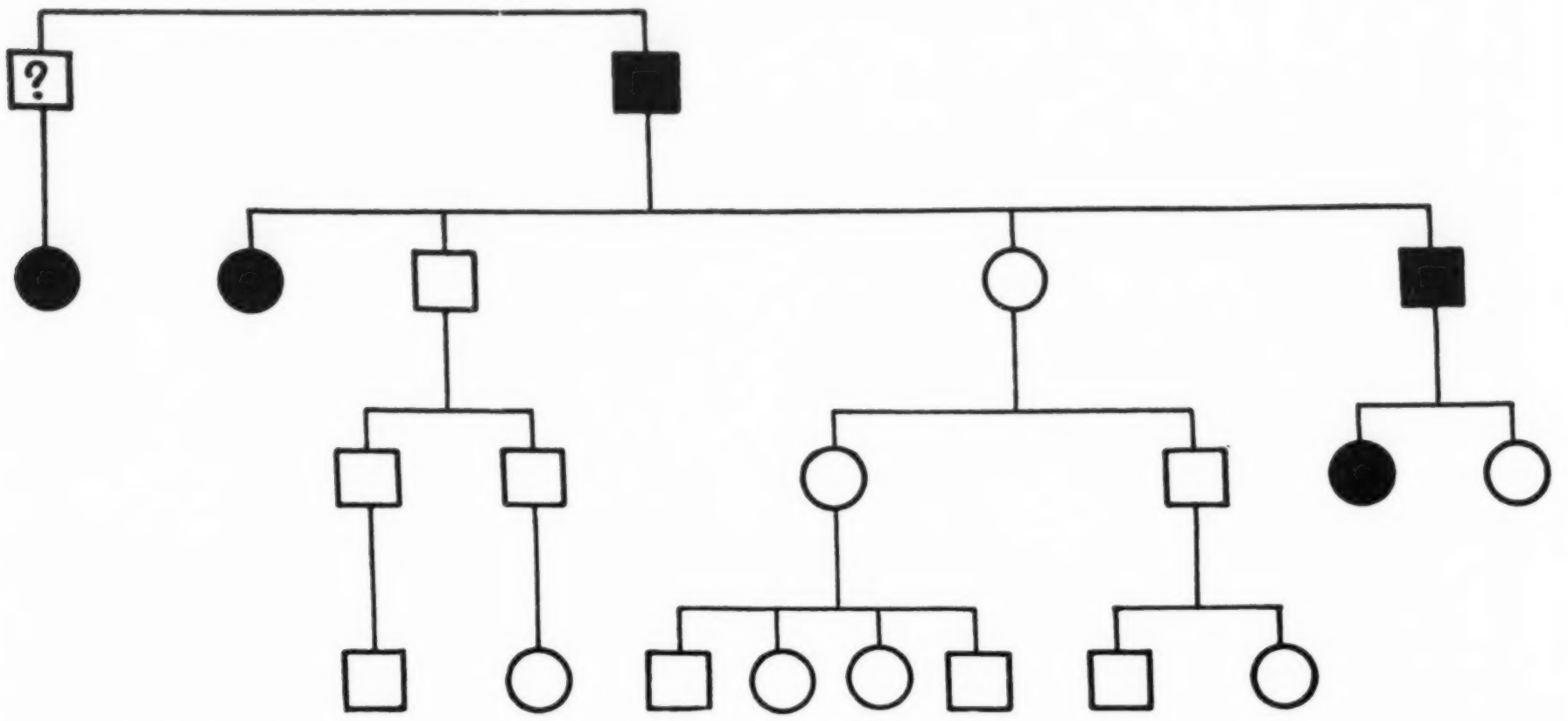
[6] Wolff, F. 1918. Ein Fall dominanter Vererbung von Syndactylie. Archiv f. Rassen- u. Gesellsch. biol., vol. XIII, pp. 74–75.

[7] Pfitzner, W. 1898. Beiträge zur Kenntnis der Missbildungen des menschlichen Extremitätenskelets. Morphol. Arbeiten, vol. VIII, pp. 304–340.

[8] Sommer, 1916. Zur forensischen Beurteilung der Erblichkeit von morphologischen Abnormitäten under der Papillarlinien der Finger. Arch. f. Kriminologie, vol. LXVII, pp. 161–174.

[9] Castle, W. E. 1922. The Y-chromosome type of sex-linked inheritance in man. Science, vol. LV, pp. 703-704.

Another Pedigree of Webbed Toes



A PEDIGREE was recently published by Schofield[1] in the JOURNAL OF HEREDITY in which a very unusual mode of inheritance was indicated. The character involved was a web between the second and third toes. This was transmitted by five web-toed men of three generations to every one of their sons (13 cases) but to none of their daughters (11 cases). Daughters of these webbed toed fathers had 2 normal sons and 5 normal daughters. The only parallel case seems to be that found recently by Schmidt[2] in the fish Lebestes reticulatus. Schmidt has pointed out that an exclusively male character which is transmitted by father to every son follows exactly the mode of transmission of the Y chromosome. Recent work by Painter[3] indicates that there is an X-Y sex-determining pair of chromosomes in man.

Another pedigree, involving what seems to be the same trait, webbing of the second and third toes, has been sent to the JOURNAL OF HEREDITY by Dr. Ira S. Wile, who calls attention to its failure to follow the rules found in Schofield's pedigree. In three cases there is transmission from father to daughter and in one case there is failure of transmission from father to son. The pedigree indicates that webbing in this case depends on a single dominant unit with no relation to sex, a conclusion which agrees with that drawn by Hurlin[4] from another web-toed pedigree, published earlier in the JOURNAL OF HEREDITY.

These apparent inconsistencies indicate that webbing may be determined by different unit factors in different families. Such a result is not especially surprising. It is known for example that night blindness follows the sex linked mode of inheritance in some families, while acting as a simple dominant in others.

S. W.

[1] Schofield, Richard, "Inheritance of Webbed Toes," JOUR. HEREDITY, (1922), 12, pp. 400–401.

[2] Reviewed by W. E. Castle, "A New Type of Inheritance," Sci., N. S., (1921), 53 pp. 339–342.

[3] Painter, T. S., "The Y-Chromosone in Mammals," Sci., N. S., (1921), 53, pp. 503–504.

[4] Hurlin, R. G., "A Case of Inherited Syndactyly in Man," JOUR. HEREDITY, (1920), 11, pp. 334–335.

AN AUSTRALIAN CITRUS RELATIVE

NOTES ON THE RUSSEL RIVER LIME

C. T. WHITE
Government Botanist of Queensland, Brisbane, Australia

IN THE Journal of the Washington Academy of Sciences (V. pp. 569–578) Dr. Walter T. Swingle has separated the Australian plants which had previously been placed under Citrus into a distinct genus which he terms Microcitrus.

One of the most interesting of these species is *M. inodora*, the so-called Russell River Lime of which Dr. Swingle (l.c. p. 578) states—

> "So far all attempts to introduce the Russell River Lime into culture have failed and the rapid clearing up of land along the Russell River threatens to exterminate the species altogether. It is hoped that Australian botanists and fruit-growers will not permit this to happen."

The United States Department of Agriculture has long been trying to get seeds of this plan for the citrus breeding experiments being conducted under Dr. Swingle, and has written many times to the Australian Department of Agriculture and Stock in Brisbane to obtain seeds of this citrus fruit as well as of *Garcinia Mestoni* or Meston's Mangosteen which grows in the same locality and in which Dr. David Fairchild has taken great interest. In January of this year I received instructions to try to collect seeds of both these plants while on a visit to North Queensland in connection with other botanical matters.

The Russell River and Bellenden Ker Ranges, the area where these plants occur, is situated in the North-east of Queensland. It is also the wettest part of Australia, the rainfall averaging over 170 inches per annum. The rainy season lasts from January to April, and during the whole of my stay in the district in early March, it rained continually and the registered rainfall for the previous month (February) was 62 inches. It is a fairly thickly settled country, most of the lower parts being given over to sugar growing.

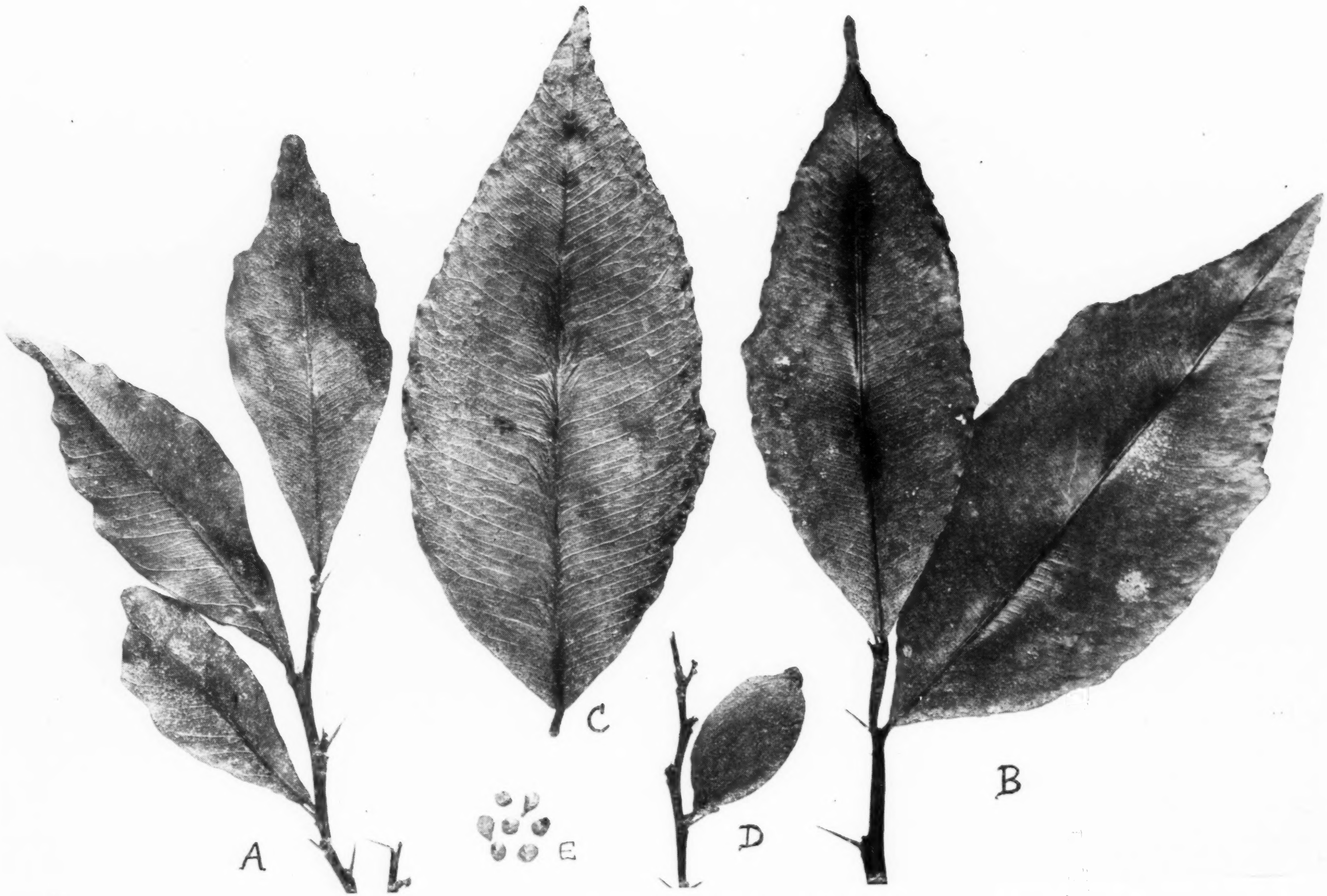
Meston's Mangosteen (*Garcinia Mestoni*) occurs on the Bellenden Ker Ranges growing from altitudes of about 2,000 feet to 4,700 feet, of "within 300 feet of the summit of the South Peak."[1] At these altitudes the tree is one of the commonest on the Bellenden Ker Ranges, if not *the* most abundant tree. It only grows to a height of 20 to 30 feet and is of very graceful appearance. It is heavily foliaged with small, long pointed, bright, glossy, deep green leaves. Unfortunately, no trees bearing ripe fruit were seen, and it is possible that the phenomenally wet weather experienced during the past season militated against fruit being set. However, as trees are abundant within 3 miles of Bellenden Ker Railway Station, on the Cairns—Daradgee Railway, no difficulty should be experienced in getting ripe seed, as soon as it is available.

Better success was met with in the case of the Russell River Lime. It was found to be common in the lowland rain forests at the foot of the mountain, and many of the trees were bearing ripe fruits.[2]

[1] Mestoni—Report by Mr. A. Meston on Expedition to the Bellenden Ker Range—Brisbane 1904 (Parliamentary Paper).

[2] Seeds (about 200) were received in June 1922 from Dr. White in good condition, as well as good herbarium specimens with fruits attached. The seeds are now being grown in the Citrus Quarantine Greenhouse of the U. S. Dept. of Agriculture at Bethesda, Md.

The other three known species of Microcitrus, *M. Australis* (round lime) *M. Australasica* (finger lime) and *M. Garrowayi* (Garroway's lime), all from Australia, are already growing in the collection of the U. S. Dept. of Agriculture. *W. T. Swingle*



LEAVES AND FRUIT OF RUSSEL RIVER LIME

This wild relative of the cultivated citrus is found only in a very restricted area of northeast Queensland. Dr. White sent in the first seeds of this variety ever received by the U. S. Department of Agriculture. There are only three known species of the genus Microcitrus, all of which are found in Australia. A, twig from a tree growing on the edge of a clearing; B, one from a tree growing in the shade of the forest; C, under surface the leaf from same tree; D, fruit; E, seeds. Photograph one-half natural size. (Fig. 15.)

It comes up freely as a second growth after the forest has been cleared, and many trees are found along the edges of clearings, in such situations they seem to fruit very heavily, although the trees themselves do not seem to be as healthy as those growing in the shade of the heavy rain forest.

The description of *Microcitrus inodora* given by Bailey (in Botany, Bellenden Ker Exped. p. 34, 1889 and Queensland Flora I. p. 215, Plate 10, 1899—under *Citrus*) might be amplified by a few details.

Microcitrus inodora forms a shrub or small tree of rather straggling habit, about 8–12 feet high with a trunk diameter of 1½–2 inches (4–5 cm). The leaves vary considerably in size and trees growing in the open or on the edges of clearings are always similar to those described by Bailey (l.c.) but when growing in the shade of the heavy tropical forest they vary considerably, attaining a greater size, particularly in breadth; leaves up to 7 in. (18 cm) in length and up to 4 in (10 cm) in width being met with. The trees were not in flower at the time of my visit but bore numerous fruits. The fruit is bright lemon yellow when ripe, oblong or obovate in shape, and may be either quite smooth or somewhat ribbed, with ribs corresponding to the cells or loculi, although this latter character, stressed by Bailey and again by Swingle, (l.c. p. 577) is a rather unusual, almost an abnormal feature. The larger fruit attain to a length of 2½ in. (6.5 cm) and are 1¼ in. (3 cm) in diameter, but the average is rather smaller. They are 8 celled and possess the characteristic rather loose stalked pulp-vesicles of other species of Microcitrus.

It is interesting to note in passing that all the Australian species of Microcitrus occur in Queensland. The Queensland flora has very close affinities with that of Papua, particularly with the Southern coast of Papua, from which two endemic species of Citrus have been described, viz *Citrus papuana* Bail. and *C. Warburgiana* Bail.[3] The flowers of both these species are unknown and it would be interesting to note into which genus—Citrus or Microcitus—at least one of them should be placed. *C. papuana* possesses a large orange-like fruit and a leaf with a winged petiole; it is no doubt a true Citrus. *C. Warburgiana*, on the other hand, bears a small fruit and short stalked leaves: it may when better known, have to be classed under Microcitrus.

The Psychopathic Child

JUVENILE DELINQUENCY, by Herbert Henry Goddard, director, Ohio Bureau of Juvenile Research. Pp. 120. New York, Dodd, Mead & Co., 1921.

American courts are picking up many thousands of delinquent boys and girls every year. "A very small percentage of them are ever restored so as to contribute their share to the general welfare. The most of them are always a burden and many of them become our most dangerous criminals." To remedy this state of affairs, the first thing necessary is a careful study of these juvenile delinquents, and Dr.Goddard's little book is in large part devoted to a description of the work of the Bureau which he heads. He undertakes to offer no ready-made program of remedies, but he does stress the importance of congenital syphilis in the causation of what he considers one of the most serious problems—that of the psychopathic child. The feebleminded child is mentally defective, or undeveloped; but the psychopathic child is mentally diseased—it is a case of incipient insanity. The author sees great hope for progress in the study of this type, and the study of its relation to syphilis in the parents.—P.P.

[3] Annual Report on British New Guinea, 1900-01, p. 142, with a Plate.

FIGS WITH MISPLACED SCALES

The fig has a very peculiar structure, not closely paralleled in other families of plants, the fruit being in the nature of a hollow branch with the flowers on the inside. A minute aperture at the end of the cavity allows the fig-insects to bring in pollen and fertilize the flowers. Normal figs have small scales, or "bracts," at the mouth of the aperture and at the base of the stalk, but scales are not scattered on the surface of the fruit as in the more or less abnormal specimens shown in these natural-size photographs.

Such abnormalities occurred on many trees in a seedling orchard at Bard, California, in the spring of 1917. Some fruits had only one or two scales misplaced, others several scales, while the more striking cases had scales in a regular spiral sequence or forming a distinct rim, as though two fruits were partially formed, one inside the other. (Fig. 16.)

FIGS WITH MISPLACED SCALES

The structure of the normal fig fruit as a shortened, fleshy branch is more easily understood from a study of these abnormal figs. Since each of the scales may be supposed to represent the leaf of a specialized joint, or internode, of the fruit-branch, the scales serve to indicate the number and arrangement of the internodes of which the fruit is composed. Interpreted in this way, the fleshy wall of the fruit evidently represents a series of internode elements standing side by side and completely fused, though the scales remain distinct.

In normal fruits the component internode elements are of equal length, though unequal in these abnormal fruits, which accounts for the scales being misplaced. Some relatives of the fig have hollow inflorescences uniformly covered with scales, showing that the internode elements are not specialized into two distinct kinds as in the fig fruits. The loss or reduction of specialization in internodes or other organs is characteristic of a large class of abnormalities which have been called metaphanic variations. (Fig. 17.)

THE INHERITANCE OF ABILITY

A study of the rôle of heredity in Terman's case histories of forty-one superior children

DORIS DAVIDSON
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IN A RECENT book, Professor Lewis M. Terman of Stanford University has presented case studies of 41 children who were found by mental tests to be exceptionally intelligent.[1] It seemed worth while to extract the data he gives regarding their ancestry, in order to bring this feature of the story into relief.

Concerning the parents or the hereditary strain of six of these children, there are no data given. What we know about the parents of the remaining thirty-five children, as is shown by education, occupation, and family connection, would seem to indicate that the parents of superior children are, in almost all cases, themselves superior. In many cases full information about the parents and relatives is not obtainable but a study of what we have reveals the following interesting facts:

In twenty-two cases the occupation of the father is given. Of the twenty-two, eighteen are professional men.

In seventeen cases one of the parents is a college graduate. In several other instances the parents are spoken of as "well-educated," "of superior ability," etc., but no indication is given of how far they went in school.

Seven of the children have both father and mother who are college graduates.

The parents of four have only common school education. In three of these cases some relatives are mentioned as being superior.

Only in two cases is it said that there are no superior relatives on either the father's or the mother's side. In both these families there are other remarkably bright children beside those tested so it would appear that there must be some superiority in the stock from which they came.

Eleven of the children have unusually fortunate heredity. In many cases the superiority has been noted for several generations and is widely distributed among various branches of the family. The superiority is usually general in both child and parents but where it is focussed upon a special subject, the particular interest of the child is almost as likely to be different from that of his parents or relatives as it is to be like it. At least one parent of ten, of the eleven children, who ranked at 150 or higher was a college graduate.

A brief record of the heredity of each of the "Forty-one Superior Children" follows:[2]

No. 1, Score 166. Father a professional man. Mother a university graduate and former teacher. Maternal grandmother a university graduate and school principal with marked mathematical ability, which is also shown by the child.

No. 2. No record of his heredity given.

No. 3, Score 150. Father superintendent of schools.

No. 4, Score 153. Father a college professor and journalist. Mother a college graduate of unusual ability and musical talent. Several relatives of superior ability.

No. 5, Score 147. A sister of No. 4.

No. 6, Score 144. Father of superior ability. Mother secretary for a large business firm.

No. 7, Score 146. Father, French. Mother, American. Musical family. Great grand uncle was Meyerbeer the French composer. Another uncle is a

[1] Terman, Lewis M. The Intelligence of School Children, chap. xi. Boston, Houghton Mifflin Co., 1919.

[2] The rank of "score" mentioned is the intelligence quotient. The normal intelligence, or average at a given chronological age, is taken as 100.

locally well-known violinist and composer. The child has great interest in medicine.

No. 8, Score 148. Ordinary parents of common school education. Mother somewhat above the average. Distant relatives in high church positions. Dull brother.

No. 9, 10, Score 131, 137. Father a barber. Mother a tailoress. No relatives of more than common school education or superior intelligence.

No. 11, Score 167. Father an able minister. Mother of superior intellectual and personal qualities.

No. 12, Score 159, 158. Father a minister of exceptional ability.

No. 14. No record.

No. 15. No record.

No. 16, Score 139. Nothing given about parents but she has a brother and a sister of marked superior ability. Both are university graduates at 20 and 21 years of age. The sister has done post-graduate work and the brother holds a responsible position.

No. 17, Score 140. Father a college professor. Several relatives of superior ability on both sides.

No. 18, Score 151. Great grandfather was a chum of Abraham Lincoln and a candidate for Senator when he died at 35. A brother of this man was a noted attorney. The father is an attorney; the mother a former high school teacher. Uncles of the mother were political leaders in the early history of Kentucky.

No. 19, Score 142. Father a carpenter of common school education. Mother, a former teacher. There are seven superior children in the family.

No. 20, Score 172. Father a physician. Mother common school education. Several superior relatives and a bright brother.

No. 21, 22, Score 140, 151. Italian children. Parents well educated. Three of grandparents exceptionally bright and well read: one a scientist and linguist, another a talented singer. Relatives of culture and learning on both sides.

No. 23. No record.

No. 24, Score 141. One grandfather a banker; the other a railway official; both intelligent and educated. Both grandmothers well educated and keen. James McNeill Whistler, artist, is a cousin of one grandfather. On the father's side there is an uncle who is a sculptor and painter. Several bright cousins and relatives. The child has talent in art.

No. 25, 26, Score 141, 148. Several relatives of very superior ability.

No. 27, Score 147. Father a mining engineer. Mother a teacher. Grandfather a teacher of superior ability. Uncle is a doctor of divinity and a bright scholar. One cousin of exceptional ability in mechanical engineering; another is one of the best mathematicians Harvard has had for years. Relatives farther back on his father's side are Roger Williams and Colonel Crawford.

No. 28, Score 137. Father a college professor.

No. 29, Score 144. Two uncles on his mother's side of exceptional intelligence. Great great uncle was a doctor of divinity and one of the foremost pulpit orators of his day. There are two bright brothers.

No. 30. No record.

No. 31, Score 141. Father a minister. Maternal grandfather an army officer and graduate of Oxford. Maternal grandmother of musical ability. Of eight uncles on this side two were able lawyers and three were successful engineers. Great grandfather was a prominent Canadian statesman. Paternal grandfather, a college graduate. Paternal grandmother, musical. Only uncle on this side is an expert chemist whose sons show unusual literary ability. Great grandfather was one of the leading spirits in the old Hudson Bay Co.

No. 32, Score 174. Father a jeweler. Mother a milliner. Both have a common school education only. No superior relatives except three remarkable brothers and sisters.

No. 33, Score 150. Both parents are physicians. Mother's relatives chiefly doctors, lawyers, and ministers. Ma-

ternal grandfather a journalist and politician.

No. 34, Score 147. Father a teacher. Mother of marked intellectual ability. Ancestors are farmers of common school education. A distant relative is a lawyer of national reputation.

No. 35, Score 134. Maternal grandfather was an able school teacher. Maternal grandmother a student at 82. Uncles are successful business and professional men. Aunt a talented musician. Mother's brother was a leader of his university class but became insane. Paternal grandfather and grandmother were both school teachers. Uncle, a lawyer and judge. Great grandfather served the longest term in the New York legislature up to this time. One relative is a noted Congregational minister in New York City and another a famous surgeon.

No. 36, Score 146. Both parents of English descent. Father a scientist educator, publicist. The child's two brothers are average, one sister was very superior and another has exceptional ability. A number of superior relatives on both sides. An uncle on the mother's side was an admiral of the United States navy. There are many distinguished relatives on the father's side including Ralph Waldo Emerson.

No. 37, Score 137. Father an able lawyer and a man of more than ordinary ability. There are many prominent relatives including Samuel Adams.

No. 38. No record.

No. 39. Father a lawyer and a graduate of the university at 21. Mother a teacher. Grandparents of average ability. Uncles and aunts average or above.

No. 40, Score 131. Mother a woman of refinement and intelligence, the author of two novels and a number of poems. She wrote essays on sociological subjects at least one of which was published in an English periodical of international circulation. She was an idealist imbued with advance notions regarding religion, sociology and woman's place. The father was an unsuccessful member of a distinguished family. Paternal grandfather was Archbishop of Ireland and dukes and earls are numbered among his cousins.

No. 41, Score 184. Father a Russian Jew. Mother a Polish Jew. Father an advertising man and writer; published three books of fiction. Mother a high school graduate and did some work in a university; has written short stories and poems for various periodicals. Maternal grandfather was a business man of high intellectuality. There are two cases of musical ability on the mother's side, also several distinguished rabbis. Paternal grandfather a business man of unusual mechanical ability fond of making and solving problems. Paternal grandmother taught herself to read English late in life. There are rabbis on this side also.

THE HOME AND THE SCHOOL

O. F. Cook

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"*ONE father is better than a hundred schoolmasters*. This was a proverb before the sixteenth century, and do we come out by any other door today? Our vast, complex system of education is failing to educate; twenty-five million boys and girls are at last being standardized in the schools of America with the precision and efficiency of a machine shop; they are primed with information which is assembled just as a Ford car is assembled, and the result is becoming the nation's despair. They know everything and have no sense! Reformers run hither and yon, but there is no ready-made solution that will sove the problem. The home undoes the day's lesson; you must reach the parents; you must educate the adult before you can make any headway with the child; education must begin at home, indeed, what is this conclusion at which we are bringing up but that *One father is better than a hundred schoolmasters?*" (The Villager, April 1922).

One of the active reformers writes:

"The transmission of character and ideals comes best from personal intimate contact of maturity with immaturity, which only a small college can furnish."

Of the need of such contacts before the college stage is reached, nothing is said. Our pedagogues take it for granted that children shall be born and raised, and turned over as raw material to be manufactured in educational institutions. Perhaps the basic fault of our educational system is its failure to recognize the home as the fundamental educational institution, and the parents as the indispensable teachers. The transmission of character and ideals is a fact of human development that needs to be studied from a biological standpoint, no less than other forms of transmission through the germ-cells.

The normal instinct of children is to follow and imitate their parents, as of parents to care for their children. These are the fundamental educational instincts that make human progress possible through the accumulation and transmission of experience from one generation to another. Civilization is the accumulated experience of the race. Longer periods of infancy, childhood and youth permit more experience to be transmitted, and more advanced stages of civilization to be attained. Breaking the contacts between the generations tends to subvert civilization because the experience of children kept by themselves does not go beyond the stage of barbarism. The "youth to youth principle" is invoked by some educators in defending their system, but is a dangerous fallacy that would reduce all the children to the condition of orphans in asylums, deprived of normal contacts with parents and elders.

The basis of character and ability no doubt is organic and hereditary, while the individual attainment is a physiological reaction of the organism to its environment, and is determined very largely by the early post-natal conditions which our present educational system almost completely disregards. Germinal transmission of high intellectual and social qualities is ineffective if the full expression of the desirable characters is prevented by unfavorable environments or bad habits. Every breeder of improved plants or animals knows that favorable conditions must be provided if the full development of desirable characters is to be expected, and that even the best stocks will show inferior behavior under distress conditions.

How many children grow up under conditions of full attainment of possibilities? No farmer could afford to raise a crop or keep a breed of cattle with so large a proportion of failures.

Teachers blame parents for neglect, but schools teach nothing about children or parental responsibility. Thus we reach the paradox that education, in the most general and fundamental sense that relates to the parental contacts, is left out of account by our "institutions of learning." An overgrown school system is disintegrating the family organization of society. To serve as the basis of a genuine, constructive educational reform, the special educational value of the parental contacts needs to be discovered and elaborated, and such information widely disseminated, like our recently acquired knowledge of the wonderful functions of the vitamines of common foods.

Tracing the evolution of our school system may explain this blind spot in our educational eyesight. The system was inherited from Europe, and goes back, as we know, to Mediaeval times, when the only schools were in the monasteries. The decay of civilization in the Roman Empire was so complete that only the monastic institutions survived, where a little of the light of civilization was kept burning through the night of the Dark Ages. Men took refuge from a ruined world and sought in the monasteries a life as far as possible from any interest in the bearing and raising of children, except as objects of pity in orphan asylums, to rescue more brands from the burning. The idea of escape or retirement from the world is still dominant in scholastic institutions. Our universities are "semi-monastic," as an eminent educator has said. Schools of lower rank are faced toward the universities, away from home and family life.

African savages think that they become civilized by putting on clothes, but *our* mediaeval ancestors fell under the obsession of the school, and we still are afflicted with a pathetic belief in going to school as an essential of mental development, notwithstanding all evidence to the contrary. Clothes undoubtedly are useful for some purposes, and schools also are useful, for the purposes that they can accomplish. But savages injure themselves with clothes, and schools have limitations and detriments that need to be recognized and avoided, in the interest of true education.

In recent efforts to make education more practical we have made our schools more like factories, not more like homes. In our mechanically graded schools, with children of the same age and mental development kept strictly together, we have gone to the extreme of denying contacts with parents, or even with older children. A book has been written on "The Artificial Production of Stupidity in Schools," but scarcely makes a beginning of the subject. Ellen Key has a chapter on "Soul Murder in the Schools," with this fundamental indictment:

> "The desire for knowledge, the capacity for acting by oneself, the gift of observation, all qualities children bring with them to school, have, as a rule, at the close of the school period disappeared. They have not been transformed into actual knowledge or interests. This is the result of children spending almost the whole of their life from the sixth to the eighteenth year at the school desk, hour by hour, month by month, term by term. . . . "

It should not surprise us that "our vast, complex system of education is failing to educate," since it is very poorly adapted to the purpose. Yet the system goes on increasing in size and complexity, having a momentum of its own, because we are all trained to believe that the mental development of children depends on the school machinery. "This is what we believe, though we know it is not so," as a Christian Indian said in recounting a heathen tradition. We know that more depends on the home than on the school and that the responsibilities of parents are many times greater than those of teachers. The system provides special schools, examinations and licenses to certify the competence of teachers. Competence of parents becomes a practical concern only as we attain a constructive, eugenic purpose. In the words of the Reverend George Herbert:

> "Studie this art, make it thy great design;
> And if Gods image move thee not, let thine."

THE BREADFRUIT

A PLEA FOR THE PRESERVATION OF VARIETIES

The Marquesan Islanders Are Rapidly Disappearing, and Will Soon Carry Their Breadfruits with Them to Extinction, Unless Measures are Taken to Preserve the Numerous Varieties of this Useful Tropical Fruit

P. J. WESTER
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Manilla, P. I.

MYTHICAL ORIGIN

"IN THE reign of a certain king when the people ate *Araea*, red earth, a husband and wife had an only son whom they tenderly loved. The youth was weak and delicate, and one day the husband said to the wife: 'I compassionate our son, he is unable to eat the red earth. I will die and become food for him.' The wife said: 'How will you become food?' He answered: 'I will pray to my god; he has power and he will enable me to do it.' Accordingly he repaired to the family *Marae* and presented his petition to the deity. A favorable answer was given to his prayer, and in the evening he called his wife to him and said: 'I am about to die; when I am dead take my body and separate it; plant my head in one place, my heart and stomach in another, and then go into the house and wait. When you shall hear a sound, first like that of a leaf, then of a flower, afterwards of an unripe fruit and subsequently of a ripe fruit falling to the ground, know that it is I who am become food for our son.' He died soon after. His wife obeyed his injunction, planting the stomach near the house as directed. After a while she heard a leaf fall, then the large scales of the flower, then the unripe fruit, afterwards one full grown and ripe. By that time it was daylight. She awoke her son and took him out and they beheld a large, handsome tree with broad, shiny leaves loaded with breadfruit."

So, according to tradition in Tahiti, originated the seedless breadfruit, the "staff of life" of the South Sea Archipelagoes.

Paradoxically enough, considering its potential value as an abundant source of nourishing, palatable and wholesome food, there is no tropical fruit today so neglected and of so little actual importance as the breadfruit, for the teeming populations of the Pacific islands whose principal means of subsistance it was, have dwindled to a mere handful.

A PLANT INTRODUCTION ROMANCE

Many fantastic stories have been told about the breadfruit. Byron, for instance, says:

The breadfruit tree, which without plough-
share yields
The unreap'd harvest of unfurrow'd fields
And bakes its unadulterated loaves,
Without a furnace in unpurchased groves,
And flings off famine from its fertile breast,
A priceless market for the gathering guest.

The breadfruit, however, is not a wheaten loaf which may be plucked from the uncared-for forest tree, though it is the nearest approximation thereto in the vegetable world. Solander, who accompanied the famous Captain Cook, and one of the first botanists to see the breadfruit, called it "the most useful vegetable in the world." Indeed, tales of the breadfruit by travellers and pirates of those early days so fired the imagination of the stay-at-homes that the British Government despatched a ship to Tahiti to take the new vegetable wonder to the British colonies in the West Indies, providing what is perhaps the most dramatic incident in the history of plant introduction.

The *Bounty*, a vessel of about two hundred and fifteen tons burden, under command of Lieutenant Bligh, was fitted up for a voyage to the Society Islands and sailed from England in 1787. After crossing the equator the commander steered for Cape Horn

to enter the Pacific, but contrary winds in that inhospitable region drove him back and forced him to sail for Tahiti by way of the Cape of Good Hope. When the *Bounty* at last anchored at Tahiti nearly a year had passed since her departure from England. Six months were occupied in loading the vessel with a thousand breadfruit plants. During this time the enchantment of the island and its beautiful maidens had so captivated the sailors that a month after sailing away they mutinied, placed Lieutenant Bligh in a life boat with eighteen men who had remained faithful to him and returned with the ship to Tahiti. They induced several Tahitian men and women to join them and again sailed away and finally beached the *Bounty* on the isolated island of Pitcairn, where the colony was discovered some twenty years later by an American sea-captain. Lieutenant Bligh, after journeying more than four thousand miles in the open boat, eventually reached Timor in the Moluccas, the most remarkable crossing of the Pacific that has ever been made, and thence found his way back to England. Nothing daunted, the British government again dispatched him on His Majesty's ship *Providence*, to repeat the adventure. This ship left England in August, 1791, reached Tahiti in April of the following year and arrived in the West Indies in January 1793, with about 700 breadfruit plants.

THE FRUIT

The breadfruit is a stately tree, occasionally reaching a height of about 20 meters, with a handsome top of large, dark green, more or less cleft leaves. The fruit grows singly or in bunches of two or three near the end of the branches, is from one to four kilos in weight, roundish to short-oblong in form, and frequently irregular in outline. The surface of some varieties is covered with short, soft spines, while in others it is comparatively smooth and reticulate, the spines being reduced to a series of flat, tubercular projections. The immature fruit is green with white, spongy and fibrous flesh. It is inedible when raw, but when peeled and sliced may be baked, boiled or roasted, then resembling a sweet potato in texture and flavor and serving as a wholesome, palatable, starchy vegetable food.

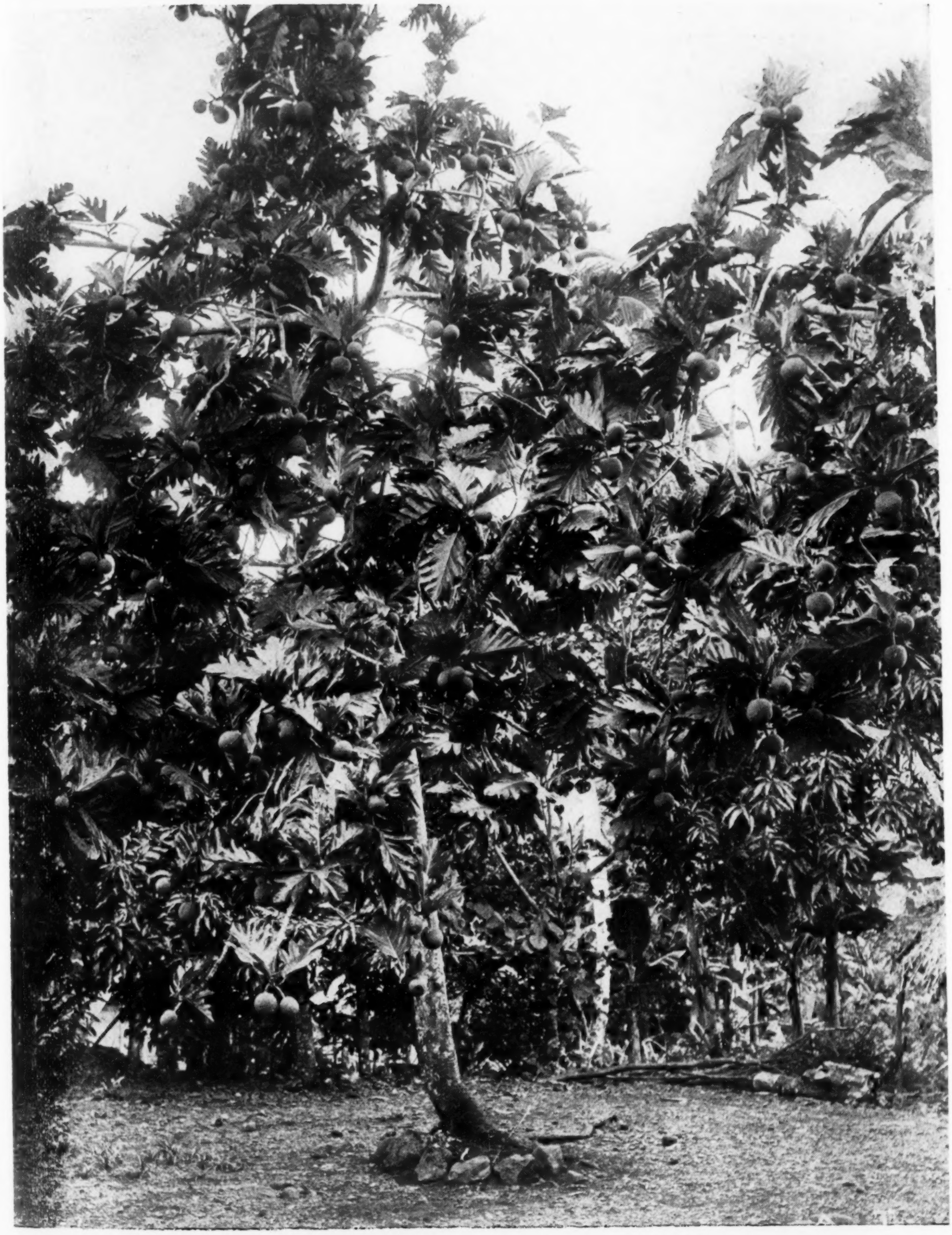
The surface and flesh of the mature fruit are yellow. It exhales a sweet, rich aroma, so strong that a single specimen fills a large room with fragrance. The flesh is soft and sweet. Peeled and cut into thick slices and baked, it is delicious eaten alone or with cream, still retaining to some extent the rich aroma peculiar to its uncooked condition.

Quiros, the first white traveller to describe the breadfruit declared, "there is no fruit superior to it."

Wallace, the eminent naturalist, said, "With meat and gravy it is a vegetable superior to anything I know either in temperate or tropical countries. With sugar, milk, butter or treacle, it is a delicious pudding, having a very slight and delicate, but characteristic flavor which, like that of good bread and potatoes, one never gets tired of."

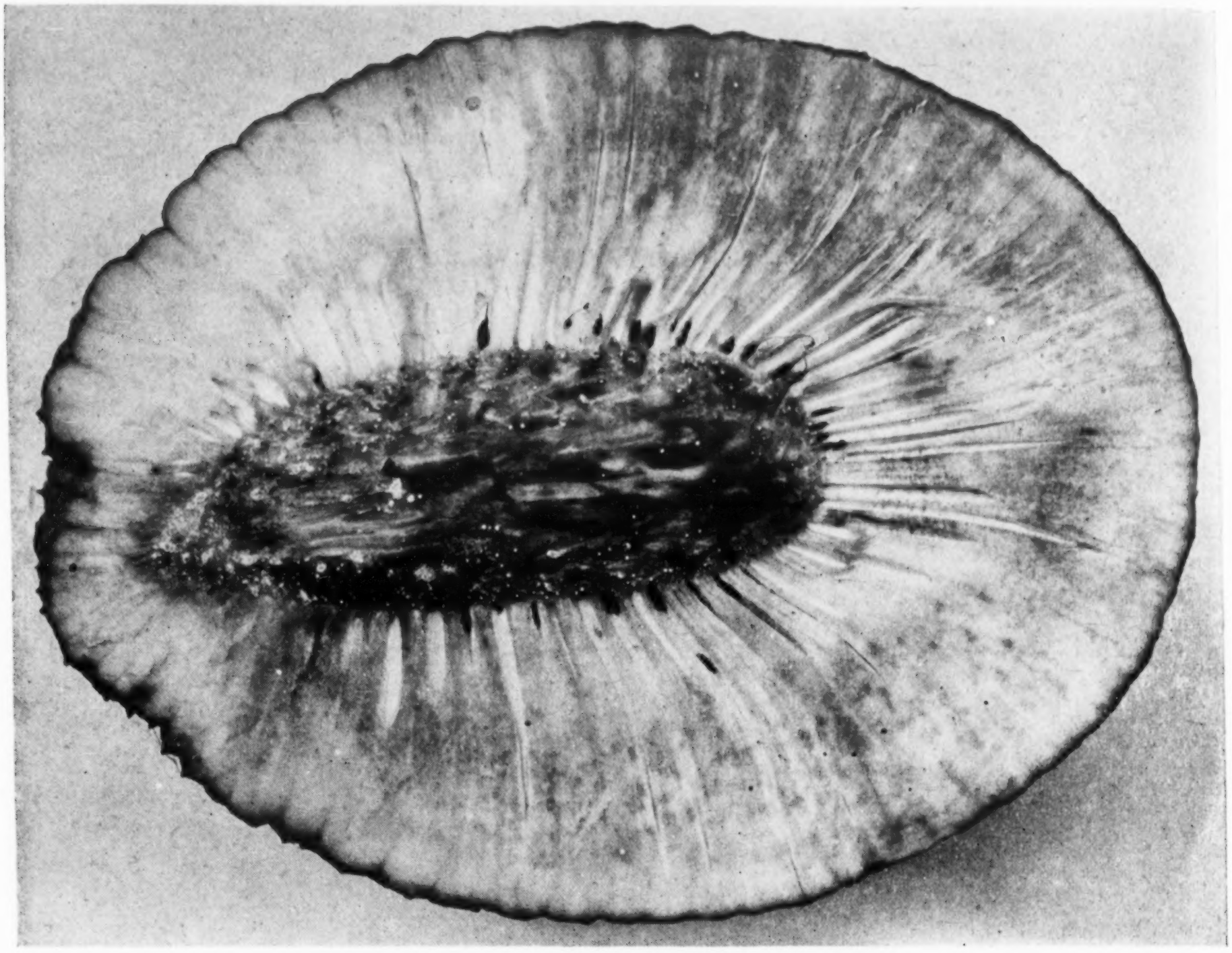
The following extravaganza by the famous Captain Cook, probably more than anything else was responsible for the dispatch of the *Bounty:* "Of the many vegetables that have been mentioned already as serving them (The Tahitians) for food, the principal is the breadfruit, to procure which costs them no more trouble or labor but climbing a tree. The tree which produces it does not indeed shoot up spontaneously but if a man plants ten of them in his life time, which he may do in about an hour, he will as completely fulfill his duty to his own and future generations as the natives of our less temperate climate can do by plowing in the cold of winter and reaping in the summer heat as often as these seasons return; even if, after he has procured bread for his present household, he should convert a surplus into money and lay it up for his children."

There are no breadfruit orchards anywhere, and accurate statistics as to



THE BREADFRUIT TREE

One of the most amazing marine adventures in history is connected with sending the *Bounty* to the South Seas to take breadfruit trees to the West Indies. After leaving Tahiti the crew of the *Bounty* mutinied and placed the commander, Lieutenant Bligh, and eighteen members of the crew in an open boat with a small supply of food and water. Thus equipped they performed a successful voyage of 4,000 miles, being at sea nearly a month. They suffered terribly from exposure, as the weather was very bad, and from lack of food and water. Lieutenant Bligh finally became an Admiral, and was always known as "Breadfruit Bligh." (Fig. 18.)



CROSS SECTION OF BREADFRUIT

This fruit is the staff of life of the people among whom it is found. Its importance is indicated by the great number of varieties recognized by the natives, each of which has a special name. In addition to using it fresh the South Sea Islanders have developed a method by which the breadfruit can be preserved for years in what they consider an edible condition. It is placed in pits lined with leaves, and allowed to ferment, somewhat like ensilage or saurkraut. This "kraut" is baked into cakes, relished by the natives, but looked upon by Europeans much as the islanders look upon our cheese. (Fig. 19.)

yield are not obtainable, but it is conservatively estimated that a hectare will yield not less than 25 metric tons of fruit per annum.

Analyses made in Hawaii indicate that 84 percent of this amount is edible, and that it contains approximately 14.5 percent sugar, 9.2 percent carbohydrates other than sugar, and 0.5 percent fat—about the same analysis as the banana except that the waste in the latter is 13.5 percent greater. It is not to be wondered at that the breadfruit became the staff of life of the people among whom it originated.

Notwithstanding its evident value as a foodstuff and the enthusiastic reports of the early voyagers, the extraordinary fact remains that there has been no systematic attempt to study it comprehensively. This is not due to lack of knowledge that the breadfruit occurs in numerous distinct varieties, for this has been known for many years. Besides having economic value, a comparative study of these various forms occurring throughout Oceania would be important in that it might furnish new evidence relative to the migrations of the Polynesians. If it were found, for instance, that varieties growing in the Fijis, the Marquesas, and the Carolines were identical, this would be strong evidence that they had been carried from a common center of distribution.

VARIETIES

The botanist, Solander, who accompanied Captain Cook noted some twenty breadfruits in Tahiti, but his variety list has never been published, and curiously enough, in spite of the interest aroused by the discovery of the fruit, nearly a century passed before the first comprehensive account of it (by Seeman) appeared in print. Seeman, writing from Fiji, recognized there the following thirteen varieties:

Balekana, Bokasi, Buko, Dina, Kalasai, Kio, Koko, Lolo, Varaka, Vonu, Votovoto, Rokouta, and *Sorena,* all of which, except the last, are said to be seedless. Wilkes, of the United States Exploring expedition, stated that there were twenty breadfruit varieties in Samoa, but did not give their names.

Bennett, in "Gatherings of a Naturalist," gives an annotated list of the breadfruits in Tahiti in which he enumerates the following varieties:

Afatu, Anuanu, Aravei, Buero, Faara, Iofai, Maire, Maohi, Ofatia, Opiha, Otea, Oviri, Pafai, Pafara, Paea, Pehi, Peiahuri, Piipiia, Rare, Raumae, Rautia, Roru, Tao, Tatara.

In "The Caroline Islands," 1899, Christian enumerates the following names of breadfruit varieties from that Archipelago:

Apil, Chai, Chaniak, En-chak, En-charak, En-cherrichang, En-kaualik, En-kotokot, En-machal, En-monei, En-paipai, En-pakot, En-par, En-patak, En-pon-chakar, En-po-te, En-put, En-uaoutak, En-ucher, Fanum, Impak, Katiu, Kumar, Kalak, Lipet, Letam, Luathar, Lukual, Nakont, Nan-umal, Niue, Nine, Nue, Paimach, Peau, Pemanthau, Ponpanui, Potopot, Pulang, Tagafei, Taik, Takai, Tal, Ti, Uaka, Yae-reb, Yao-lei, Yao-uat, Yeo-tui, Yoa-tathen, Yong, Yu-goi, Yu-ngalu.

Finally the same author in his book about the Marquesas Islands published in 1910 states that there are at least thirty-two varieties of breadfruit in that Archipelago, and enumerates the following variety names:

Auena, Autea, Fafaua, Haapuau, Hetutu, Hinu, Hoi, Kakanokoe, Koka, Koufau, Kuuvahane, Kuukou, Maoi, Maie, Mapua, Movai, Mohomoho, Onape, Orihu, Otai, Piohe, Pipi, Pitaeatae, Piti, Puahi, Pupupi, Takaha, Tapa, Tataatoetoe, Teve, Tioe, Tona, Uea, Vevee.

In "Polynesian Researches" Ellis states that the missionaries were acquainted with nearly fifty varieties of which he had the names, but unfortunately he failed to enumerate them. He says "In the Marquesas the breadfruit probably attains greater perfection than elsewhere."

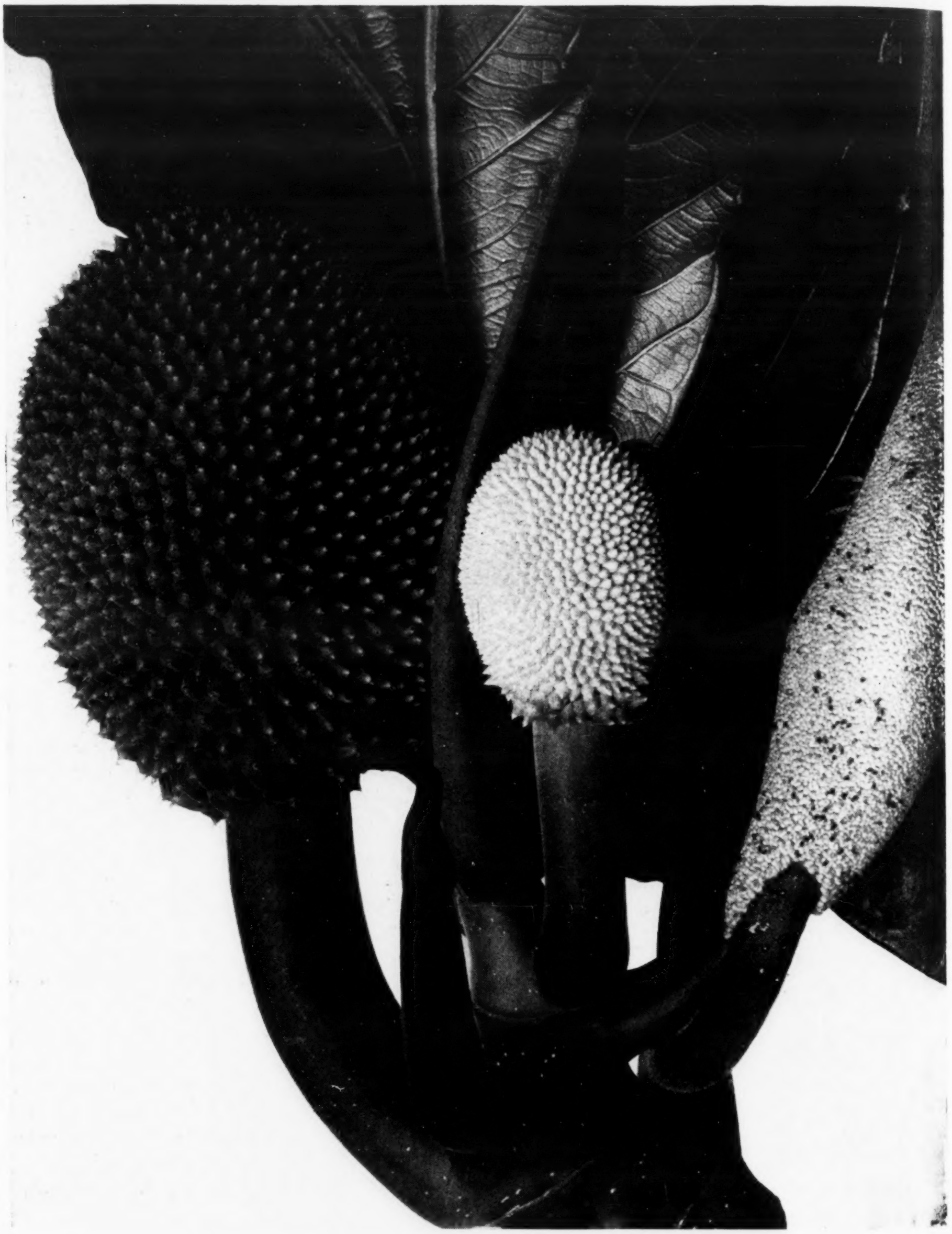
There are doubtless synonyms in each of the above lists published by Christian, and were varieties from the different archipelagoes brought together it would probably be found that some, at least, of those from different island groups are also identical. Allowing for errors and synonomy there are probably some thirty-five distinct breadfruit varieties in the Pacific Archipelagoes.[1]

ORIGIN

Where did these varieties originate, and when? An interesting problem.

The seedless breadfruit was first seen in the Marquesas by Europeans in 1595 and successively found in many forms in the other Pacific Archipelagoes as they were discovered. In the Malay Archipelago the tree was first noted by Rumphlius not earlier than 1653. At that time the breadfruit was found only in the east and southeast of the Dutch East Indies. Even yet the breadfruit is of but little importance in that region, and in a recent work Heyne records only two varieties (in Madura). The earliest record of the breadfruit in the Philippines, that of Camello, who arrived there in 1688, apparently refers to a fruit recently

[1] While this article was in press I received from Mr. Howard F. Withey, American Consul in Tahiti, a list of 52 breadfruit varieties in the Society Islands, of which 27 are described, and a descriptive list of 25 varieties from the Marquesas. Mr. Withey writes: "No other fruit in these regions yields so much per acre. With one exception all varieties are seedless. As a food there seems to be but one criticism of the breadfruit, i. e., that it does not keep well.—"P. J. W.



FRUIT, LEAVES AND FLOWERS OF THE BREADFRUIT

The male flower is on the right, the female in the center and an immature fruit on the left. The varieties used by the South Sea Islanders are nearly all seedless, but seeded varieties exist, and the seeds are eaten like chestnuts. Both kinds are considered to belong to the same species. In addition to its value as a food plant the breadfruit furnishes a fibre for making bark cloth, and timber highly valued for boat building. (Fig. 20.)

introduced from the Marianes by the Spaniards. Blanco's statement that the seedless breadfruit occurs spontaneously in Leyte (Philippines) may be safely discounted.

It would appear probable that the first seedless forms originated somewhere in the islands immediately east of Java or in the Moluccas, and were thence carried eastward by the Polynesians in their migrations. As the plant assumed greater importance as a food staple and became generally grown, it is probable that new varieties in the form of bud sports appeared from time to time. This belief is strengthened by the fact that while in Oceania there are myths purporting to explain the origin of the breadfruit, so far as the writer is aware there are none in the folk lore of the Malays of the Sunda Islands.

PROBABLE EXTINCTION

In "White Shadows of the South Seas" Frederick O'Brien says that the days of the Marquesans are numbered. In an article in the National Geographic Magazine for October 1919, J. W. Church corroborates this, and says that his census of that year found only 1,950 people alive in the Marquesas, and that in the five preceding years the population had decreased more than 33 per cent, and that ten years thence there would not be a full blooded Marquesan alive. Once populous valleys are already swallowed up by the tropical jungle.

It is a well-known fact that cultivated plants can not successfully compete with the wild vegetation when the protecting arm of man is removed. And as the Marquesan is doomed to extinction, so will his breadfruits—by travellers described as superior to all others of their kind—inevitably follow if man does not intervene. Some of these varieties may have become extinct already or be near extinction. In the Society Islands the situation is but slightly better. While the disappearance of some of the breadfruits would be an economic loss, there would be, in addition, the sentiment of the loss of that which has been the staff of life of one of the races of man which our own civilization has destroyed. Nor should it be forgotten that, although in the sciences and trades a lost art or a lost invention may be rediscovered, in the plant world this is not so, for when the last individual of a species or a variety has passed away it is irrevocably lost. Again, for all that has been written about the breadfruit and the multiplicity of its forms, the curious fact remains that not more than three varieties appear to have found their way from the South Sea Archipelago to other lands. Finally, as has already been stated, the gathering together of the breadfruit varieties in the Pacific Archipelagos for a comparative study should add further evidence relative to the much mooted question of the migrations of the peoples within those regions.

A WAY OUT

Might not the great world powers with tropical possessions unite to save the many kinds of this interesting and useful plant from extinction? Could not a trained agricultural explorer familiar with the tree be sent to bring its superior varieties from the remote South Seas to other parts of the tropics where they might thrive under intelligent care? And would not the financing of such an adventure be a benevolent enterprise which should appeal to the imagination of some philanthropist intent on serving his fellow men?

"THE MANNER OF MAN THAT KILLS"

A Review

THIS[1] is "the history of three crimes which might have been prevented, crimes which were inexcusable and a disgrace to our country. Society here punished the person it created. The original fault was the fault of society. Society, upon whom rests the responsibility, should be arraigned at the bar of Justice and put on trial and convicted instead of its product."

Bertram G. Spencer terrorized Springfield, Mass. for nearly two years, beginning in June, 1908, with a series of burglaries which had no apparent motive. In the course of one of them he shot and killed a young woman. He was finally caught, and committed for observation to a hospital for the insane. All the alienists who examined him pronounced him a defective from birth. His history from childhood itself showed that he was not a safe person to be at large in the community. But he was allowed to go unguarded until for two years he gratified his longing for sensation by daring burglaries and in a crucial moment lost control of himself and committed a murder.

After being kept in the hospital for about a year he was returned to Springfield for trial, as the result of what Dr. Briggs considers political influence, and was convicted and put to death.

The second case with which Dr. Briggs is concerned is that of Leon Czolgosz, the so-called anarchist who shot President William McKinley at Buffalo in 1901. In connection with the trial of this murderer, "no thorough, scientific investigation or study had been made of his mental or physical condition previous to his arrest." Public opinion demanded speedy vengeance, and there was apparently little desire on the part of the authorities to be "embarrassed by facts." Allan McLane Hamilton, an alienist who was called to Buffalo to examine the prisoner, was not allowed to make an examination, but he was permitted to attend the trial, and in his *Autobiography* declares, "I really do not think that in all my experience I have ever seen such a travesty of justice." Shortly after the execution of Czolgosz, Dr. Briggs undertook an investigation of the case, which satisfied him that "President McKinley was killed by a diseased man, a man who had been suffering from some form of mental disease for years. He was not medically responsible and in the light of present day psychiatry and modern surgical procedure, there is a great question whether he was even legally responsible for the death of our president."

Rev. Clarence V. T. Richeson, the third of Dr. Briggs' subjects, was the pastor of a Boston church who furnished *cause celebre* to the newspapers in 1911. He "was, I think, the only man ever executed in Massachusetts without a trial. He was a victim of hysteria with delusions, hallucinations, amnesic periods, and delirium. He had exhibited signs and had had attacks of this disease for years, had been recognized as mentally unsound by several physicians who advised specialists in mental diseases to attend him. Still, he was allowed to 'carry on' until his acts resulted in the death of a young girl in this state." He eventually confessed, and was executed.

The life histories of these three men are given at great length. In spite of some tiresome irrelevant detail, they make reading of such interest that almost any devotee of the stories of crime turned out by professional fiction writers would find them worth while.

The judicial killing of such men as those described is a rough and cheap sort of eugenic procedure, from which the race in the past has undoubtedly

[1] *The Manner of Man that Kills*, by L. Vernon Briggs, M.D., director of the Massachusetts Society for Mental Hygiene. Pp. 444, with 19 illustrations. Boston, Richard G. Badger, 1921.

derived benefit. But the time has passed, Dr. Briggs thinks, when it is the most useful method of treatment. "When we find a germ that kills people we do not annihilate it so that it is impossible to learn more about it. No, we put it under glass, nurse and study it under different conditions, find out its characteristics, its source and how it develops, so that we may be able to combat other germs of the same kind and render them at least harmless." So far as the individual murderer is concerned, the author argues that he should be turned over to men of science for study which would certainly benefit society more than the present execution of the convict does.

But Dr. Briggs' principal interest is in the prevention of such crimes. Altogether apart from the humanitarian side, the mere financial cost of the present system is excessive. It was estimated that for 1921 in the state of Massachusetts alone support of the institutions for the feeble-minded and insane would cost $8,400,000; payments for the Department of Public Welfare $4,500,000; for Department of Health $1,500,000; and Department of Corrections $1,400,000, making a total of $16,000,000, or 40% of the total annual expenditure of the state, devoted to the defective, dependent, and delinquent classes.

As has often been pointed out, the fundamental solution of this problem is the institution of such eugenic measures as will keep a large part of the "three D's" from being born. Dr. Briggs is little concerned with this solution, although in the heredity of the cases under consideration—Spencer, Czolgosz, and Richeson—there is abundant evidence of genetic defect that could hardly produce anything but trouble.

Granted, however, that something more than eugenics is needed to meet the present emergency and to deal with the existing generations, the author urges that "there is no excuse for any community not taking measures to recognize mental disease during its earliest manifestations. We should recognize the defectives not only in the schools but earlier, and then apply the remedy and not cease diligently to use all scientific means to cure mental illness before the disease becomes chronic, and so to direct and train the mind of the defective that he will at least become if not a useful, then a harmless member of society. In either case we must protect these individuals and the community from any harm consequent on their defectiveness or disease by directing their lives, if necessary, in hospitals and schools."

"Invariably an early study of the personality of these individuals will reveal certain character traits such as jealousy, cruelty, suspicion, egotism, negative self-feelings, false pride, etc., which unless recognized and corrected while their minds are still plastic will eventually lead to paths which will prevent them from making the proper adaptation to their environment, the results being crime, pauperism, mental, and physical disease.

"On the other hand if these same instinctive forces be guided and directed and perhaps the environmental factors altered, and mental and physical occupation selected to suit each case, an avenue would be established which would take that individual out of chaos into a useful and happy life."

"Some have undoubtedly been born without any sense of moral responsibility in their make-up, and a very large number have been warned by environment. Is it right to punish these individuals?"

"The alleged excuse for law is that it will act as a deterrent. It does not so act with the classes we have under discussion. It did not so act with these three individuals whose histories I have written." It is now well known that the minds of many criminals "are often of such a calibre that the fear of punishment does not deter them. With minds so primitive that they do not understand or fear death, or so diseased that they do not appreciate

the consequences of their acts, these people go on unmolested until they commit some deed which is followed by disaster and suffering. Does not all this prove that we have not the remedy in law?

"I believe we have it in scientific study and investigation, in psychopathic hospitals and dispensaries properly supported by government and community, both financially and morally, and by proper rules and regulations of society which will protect the community."

In addition to training schools and custodial institutions, the specific measures which Dr. Briggs advocates are:

1. That license to practice medicine be granted only to those who shall have passed an examination in psychiatry.

2. That all physicians be required to report to the state Department of Mental Diseases, confidentially, every known or doubtful case of mental defect or dangerous form of mental disease.

3. That "if after receiving the report of any particular case the Department of Mental Diseases believes that the said case is not receiving proper care and treatment, it may make such recommendations to the attending physician or other persons in interest as the welfare and safety of the person afflicted and of the public may require."

4. That the distinction between medical and legal insanity be abolished in chronic cases, if not in all cases.

5. That when a recidivist comes up in court, the Department of Mental Diseases shall be notified and shall cause the defendant to be examined and a report on his mental condition filed to be used as evidence. "This would in no way interfere with the rights of the individual to employ experts, but it would tend to settle all questions so far as the state is concerned and prevent the deplorable condition which now exists in so many cases where our medical men are apparently pitted against each other and are held up to ridicule."

Certainly something should be done with the class of offender who comes into court time after time. It was found in 1918 that of 11,495 persons committed to Massachusetts penal institutions during the year, 6,733 or 58.5% were repeaters. "It further appears from the same tabulation that they averaged 6.8 former commitments each. In the 21 county jails and houses of correction 5,727 of the 9,719 inmates entering these county institutions during 1918 were known to have served time before, and the number of sentences served by these repeaters totalled 40,288. The records of these repeaters in county jails showed that 25 or more previous commitments was not uncommon, while some institutions housed men with as many as 100 terms of confinement against them."

Such a record shows clearly that the present machinery—judicial machinery—for dealing with such individuals is inefficient if not useless. One can hardly help agreeing with the author that the effort to treat mentally diseased persons by sentencing them to a term in jail is an anachronism, and a dangerous one.

Whether the reforms proposed by Dr. Briggs would go far toward solving the problem is open to question. The constant appearance in court of eminent medical specialists, doubtless sincere, testifying on opposite sides of a case makes the layman have less confidence in the omniscience and infallibility of psychiatrists than Dr. Briggs' recommendations suggest. But unquestionably much could be gained by greater activity of competent psychiatrists; much could be gained by changes in the Public educational system; much could be gained from the better education of parents. Perhaps still more is to be expected from changes in the birth-rate of different parts of the population.—PAUL POPENOE, *Coachella California*.

RED-GREEN COLOR-BLINDNESS IN THREE ALLIED FAMILIES

HAROLD BOWDITCH, M. D.
Boston, Mass.

THIS small piece of research was undertaken with the purpose of discovery, if possible, the source of red-green color-blindness in the family numbered 1 in the accompanying chart. The quest was unsuccessful; but in its pursuit enough cases of color-blindness were found to make it seem worth while to put the facts on record. I wish to take this opportunity to thank Prof. Leon J. Cole of the University of Wisconsin, Prof. Edwin G. Conklin of Princeton University, and especially Dr. Howard J. Banker of the Eugenics Record office at Cold Spring Harbor, New York, for their kind suggestions and criticisms, as well as numerous members of the families under consideration for their courtesy in answering questions.

In the accompanying chart I have designated males by squares and females by circles; color-blind individuals by black; carriers of color-blindness by stripes; carriers according to theory by shading, normal color-vision by N, individuals about whose vision nothing is known by white, and suspected color-blindness by a query.

It will be convenient to begin by considering the case of Family 1, Generation IV, individual No. 1, whom, for brevity, we shall call IV. 1.

IV. 1, was a professor of physiology and an authority on the physiology of vision; he wrote the section on this subject in the American Text Book of Physiology (1896). He was red-green color-blind and was much interested in the subject but I have been unable to find out that he knew how the defect descended to him. He had two brothers with normal color-vision, and three sisters, of whom two died unmarried and the third is represented on the chart as IV. 2. IV. 1 had two sons, both with normal color-vision, and five daughters; of these, two have no sons; one, V. 1, has three daughters and one son, VI. 1. who is color-blind, and the two others, V. 2 and V. 3, twins, have each two color-blind sons, VI. 2 and 3, and VI. 4 and 5 respectively. V. 2 has in addition one daughter and three sons whose color-vision is normal.

IV. 2 had one daughter and three sons; the daughter has a daughter, and of the three sons, two are color-blind, V. 4 and 5. V. 4 has a daughter, VI. 6.

IV. 1 must, according to the rule, have derived the defect from his mother, III. 2; and as it is known that her husband, III. 1, had normal color-vision, it is clear that IV. 2, also derived her color-blind carrying capacity not from him but from the mother, III. 2.

IV. 4, who was first cousin to IV. 1 and 2, was color-blind; his brother, however, is a successful painter; there are two unmarried sisters; and a married sister, IV. 3, who has had two daughters and a son with normal color-vision, and two sons, V. 6 and 7, who are color-blind. IV. 4, like IV. 1, indicates that his mother, III. 3, was a carrier, and her husband having had normal color-vision, it is evident that V. 6 and 7 get their defect through their mother's mother, III. 3.

III. 2 and III. 3 were sisters; they had a brother and two sisters who died single, and had the brother been color-blind it would have been known to IV. 1, who lived near his uncle and saw much of him. Had this been so, we might safely have attributed the defect to the mother, II. 2, but as it is we can say only that the sisters III. 2 and 3 got the defect either from a color-blind father, II. 1, or from a carrier mother, II. 2. From which of these it comes is the point I have failed to elucidate.

II. 1 was a lawyer, well known in Salem and Boston, and he lived until 1848, eight years after the birth

of his grandson IV. 1. IV. 1's mother mentions his color-blindness in a number of her letters, and had her father been color-blind it would seem not improbable that she would have mentioned the fact and hence that IV. 1 would have known whence the defect came. The only hint I have found is that a great-grandson of one of the brothers of II. 1 thinks that he remembers some stories suggesting color-blindness told about one of his great-grandfather's brothers, and attaches them in his mind to II. 1, but this is too vague to build on.

Hoping to find the defect among the descendants of II. 1's brothers I have entered into correspondence with a number of people, without success. II. 1 had six brothers and two sisters; four brothers and one sister died without issue; of the other two brothers neither had daughters who left children, and the remaining sister married her first cousin (her mother's sister's son) by whom she had two sons and a daughter; one son died at the age of four and the other, who has left three generations of descendants with normal vision, was not color-blind. Without going into further details, suffice it to say that I have gone back another generation, to the mother of II. 1 and her brothers and sisters, as well as ascertaining that her uncles and aunts all died without issue.

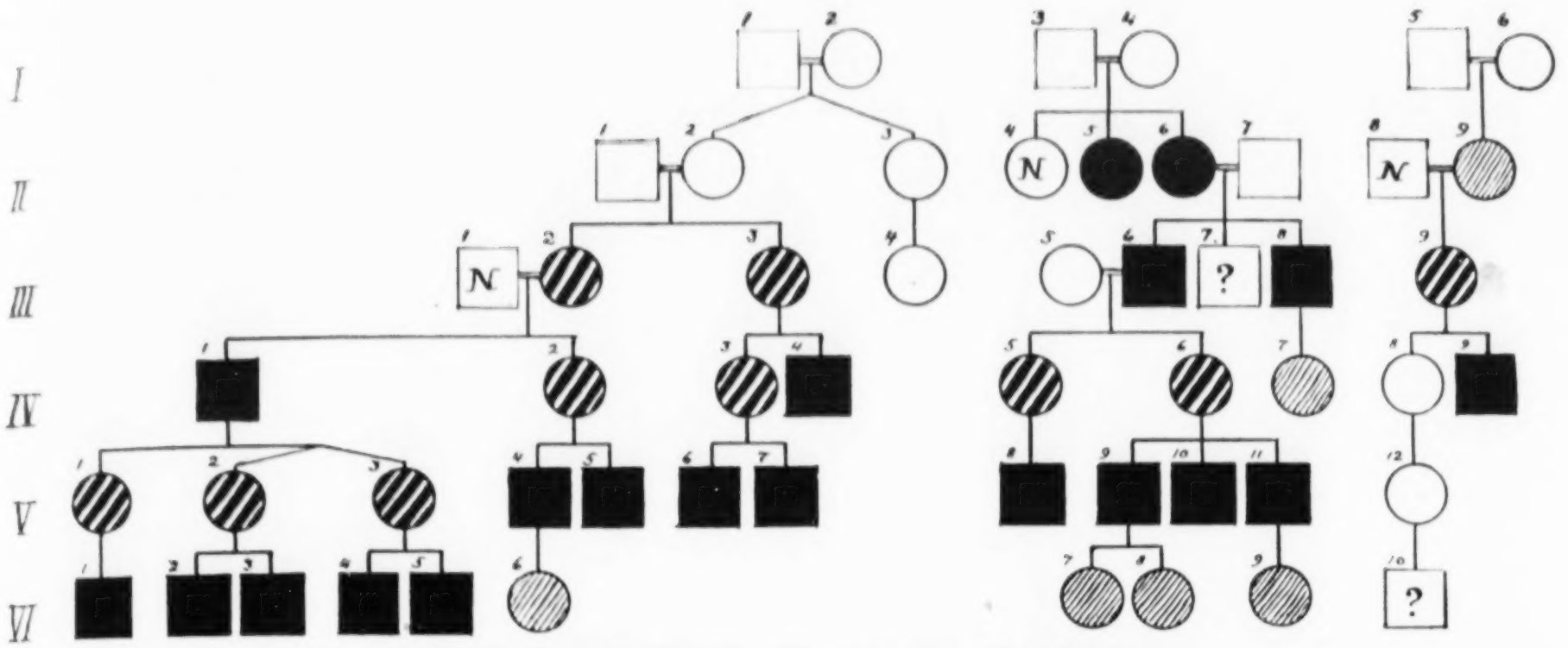
Having failed to find the defect in the family of II. 1 I turned my attention to that of his wife, II. 2. She was one of a pair of twins, only daughters; and I hoped to find the defect among the descendants of her sister II. 3. II. 3 has a single child, a daughter, III. 4, who married and had seven daughters and three sons, of whom two have normal vision, and the third had marked talent as a painter, so could hardly have been color-blind; in short, there has been no color-blindness among three generations of descendants of III. 4.

Whether or not III. 4 was a carrier, her mother II. 3, may have been. She and her twin sister II. 2 were the only daughters of I. 1, an officer in the Continental Army, who when offered the positon of adjutant-general at first declined it partly on the ground that his defective eyesight did not allow him to "survey distinctly a wide or distant area. He had experienced this defect from early life." (Quoted from his Biography.) The mere fact of color-blindness was not recognized until about the period of the Revolution so it is not surprising that his defect, if it was color-blindness, was spoken of as "near-sightedness." This officer, I. 1, wore spectacles, at that time a rarity, and was dependent upon them, an argument against color-blindness being the sole cause of his disability. About his wife's (I. 2) family I know little.

To summarize: Family 1 shows red-green color-blindness occurring in the males of three generations and following the well-known rule of transmission.

Family 2 is of greater interest than Family 1 in that we find two cases of female color-blindness. II. 4, 5 and 6 were sisters, II. 4 and 6 married and II. 5 unmarried. Both II. 5 and 6 were color-blind, but II. 4 was not and according to the rule their father, I. 3 must have been color-blind and their mother I.4 a carrier, but I have not indicated I.3 as color-blind on the chart because his was not a known case. I have been unable to get any information about other descendants because, so far as I can find out, the two brothers and five sisters of II. 6 died without issue, nor do I know whether any of them, besides II. 5 and 6 were color-blind; but according to the rule half the sisters and half the brothers would be color-blind, and the sisters who escaped would be carriers, supposing that I. 3 were color-blind and I.4 a carrier.

II. 6 had three sons and no daughters. We know that two sons, III. 6 and 8 were color-blind, and no doubt III. 7 was also, for the offspring of a color-blind woman show 100% defectiveness, color-blindness in the males, carriers in the females. III. 7 had an only child, a son, in whom the defect would not be expected to appear; he is childless.



COLOR-BLINDNESS IN ALLIED FAMILIES

Color-blind individuals are designated by black; carriers by stripes; carriers according to theory by shading; normal color-vision by N; and those about whom nothing is known by white. Normal members of the family are not shown in the chart. III.6 and III.8 married sisters of III.1 in family I, a curious coincidence of three members of one family marrying consorts of color-blind stock. (Fig. 21.)

III. 6 and III. 8 married sisters, who were the sisters of III.1 in Family 1. We thus have the curious coincidence of three members of one family marrying consorts of color-blind stock.

III. 6 had five daughters and one son. All five daughters must, according to the rule, be carriers, but two are without children and one has a son with normal vision and a daughter who has no sons; so that the defect is transmissable (to date) only through two daughters, IV. 5 and 6.

IV. 5 has two children, both sons; one has normal vision; the other, V. 8, is color-blind and has had no children.

IV. 6 has six children, three sons and three daughters. All three sons are color-blind, V. 9, 10 and 11; of these one is unmarried, one has two daughters VI. 7 and 8, and the other has one, VI. 9; these three granddaughters of IV. 6 are still in their childhood, and must be looked upon as carriers. IV. 6 has, as was stated, three daughters who are potential carriers; one is unmarried, but the other two have respectively four and two sons, all with normal vision.

III. 8 had two sons and two daughters. One daughter died unmarried, but the other, who must be looked upon as a carrier, IV. 7, had a son with normal vision, and a daughter who has had three sons, two of whom have normal vision and the third is too young to be tested.

To summarize: Family 2 starts with a color-blind woman (II. 6) and the rule of transmission is followed in that it occurs in two sons (and, for all that is known to the contrary, in the third as well), thence descending through females to males; but in this family we have no instances, as in the first family, of transmission through two female generations before it reappears in a male.

Family 3 has a short chart. II. 8 died in 1891 and his daughter, III. 9 is now living at the age of eighty-one. I rely upon her opinion for marking her father as having normal color-vision, for it seems as though such a defect could hardly have been unknown to her. She had two sons, one with normal vision, the other color blind, IV. 9; he has no children. III. 9 is therefore a carrier, and it appears safe to say that the defect came to her through her mother, a Virginian, whose family I have been unable to trace, owing, probably, to the destruction of the records in Petersburgh during the Civil War.

III. 9 has also had two daughters, who may be carriers; one is the mother of one daughter, still a child; the other, IV. 8, has one son with normal color-vision and has had six daughters of whom two have married; one has no children, the other, V. 12 has one daughter and one son. This boy, now over three years old, is as yet unable to tell the names of colors correctly and is therefore marked with a query, as it may be that the trouble is confusion of names rather than of colors. The alliance comes about in this way: V. 12 is the wife of a son (not shown on the chart) of IV. 1, (Family 1) VI. 10 being therefore a grandson, and possibly another color-blind grandson (though if so not by inheritance from his grandfather) of IV. 1.

Conclusion: The study of color-blindness in these three families, although it brings out nothing new, illustrates the truth of the accepted law of inheritance of the defect.

TWINS REARED APART

PAUL POPENOE,
Coachella, California

SINCE Francis Galton's pioneer researches, twins have been regarded as offering particularly favorable material for the study of environmental influence on inherited traits. A crucial case, because of the dissimilar environments in which the twins were reared, was recently called to my attention by Dr. Mary Lawson Neff, of Phoenix, Ariz.

A family named Irwin, living in a small town in the Black Hills, had three children—two sons and a daughter. Twin girls were then born. The mother never recovered strength, and died eight months afterward.

The twins, Jessie and Bess, were adopted by two families who lived on ranches. The former (now Mrs. Carl G. Sanders, a school teacher in Arizona) has kindly given me particulars of their upbringing.

Following their separation at the age of eight months, the two girls did not see each other, nor did they correspond, until they were 18 years old. In their entire lives, the twins have been together only two months in 1911, two months in 1913, and six months in 1914. They have now not seen each other for seven years.

Their history is outlined by Mrs. Sanders as follows:

Bess lived with her foster parents on the ranch until she was five years old, when they quit ranching, traveled overland for two years, visiting Canada in the course of this travel, and finally settled in Helena, Mont. Bess went to the public school there until she finished the fifth grade, then entered business college, and at the age of 14 went to work in an office. She has followed a business career ever since. From 14 to 18 years of age she was with the forest reserve administration, 18-22 Montana Life Insurance Company, later in New York as extension student at Columbia and secretary to the president of a publishing company. At the beginning of the war she joined the Food Administration in Washington, then went to France with the Red Cross, transferred to the Graves Photography Bureau, returned to Washington, and then to Helena. She has clerked in two state legislatures in Montana and spent several summers doing clerical work in Yellowstone Park.

Jessie, on the other hand, went to a rural school and then through high school, started to train as a nurse, had a physical breakdown, later taught school three years, married in 1915, gave birth to a son in 1916, did some open air work in subsequent years, and in 1920 began teaching again.

The physical likeness of the two is close. The two, according to Mrs.

THEY STILL LOOK ALIKE

Growing up in different environments has not made these twins look very different, and according to the evidence presented, they still think as much alike as they look. Their hair and eyes are the same color, and their weight is always very nearly the same. This case offers further evidence that the psychical makeup of the individual is largely settled by the time he is born. (Fig. 22.)

Sanders, are of exactly the same height, and nearly always weigh within a few pounds of each other. When they have been together, they have worn each other's clothes perfectly and friends found their voices indistinguishable. Their hair is identical in color, and few people can tell them apart. Mrs. Sanders' son has never seen his aunt, but cannot distinguish her photograph from that of his mother. Both have weak lungs "and have been run down from that cause, and nearly always at the same time."

"I am very sorry," the narrator continues, "that I cannot remember exact dates of illness, but many times our letters bearing word of enforced idlenesses have crossed, until we began to expect to hear of the other's illness as soon as one of us was indisposed."

The mental similarities are perhaps less to be expected than the physical resemblances, but are no less striking. To quote the informant:

"It is almost uncanny, the way we are always doing identical things at the same time. The latest instance is in having our hair cut, each without the other's knowledge. This really took courage, because the majority of our friends do not approve.

"We are both high strung and do not seem to conserve our energy as we should, but I have been resting more gracefully this summer than I ever have before, and in her latest letter she expresses the same mood.

"I believe (and of course say this without conceit) that an intelligence test would find our capacities very similar, and I surely would like to try the experiment if the opportunity presented itself.

"We both favor history, social study 'that functions,' and politics. Neither of us cares for mathematics, and I would not call either of us a good student. We are too 'smattery,' although we learn rapidly and with very little effort.

"I might add that we both seem to show some administrative ability, because we invariably hold an office in every organization we affiliate ourselves with. Last year I was treasurer of our state teachers' association, and am chairman of two county committees now. The latest letter from Bess advises that she has just been elected president of the women's division of a commercial club.

"We have never had a disagreement between ourselves, and while I am fond of my older sister and two brothers, yet they have never seemed as close to me as Bess."

It is related of the Siamese twins that if one was touched at night, *the other one* would waken and inquire what was wanted. Such mental similarity in two individuals brought up together is striking enough. But when two individuals are separated in infancy, brought up as differently as are the twin sisters described above, and still manifest such mental similarities, it is impossible to resist the conclusion that the psychical make-up of the individual is very largely settled by the time he is born.